

ANIMAL KEEPERS' FORUM



*Special Dedicated Issue on
the Polar Bear (*Ursus maritimus*)*

AUGUST 2007

The Journal of the American
Association of Zoo Keepers, Inc.

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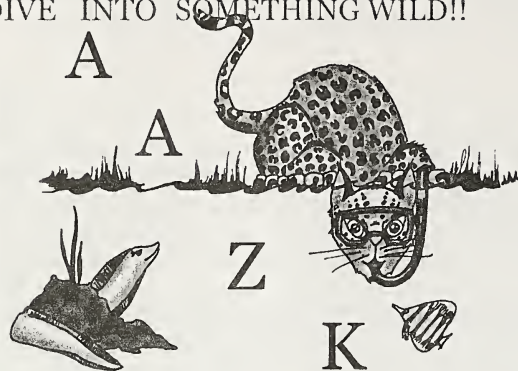
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33rd Anniversary - 1974 - 2007

DIVE INTO SOMETHING WILD!!



Dive into something WILD! Join us on the Texas gulf coast and experience an AAZK conference like never before! The 34th Annual AAZK National Conference is proudly hosted by the Galveston Chapter of AAZK and takes place in Galveston, TX from 30 September to 4 October, 2007.

THANK YOU to all the Chapter Challenge donors - Utah's Hogle, Woodland Park, Audubon, Little Rock, Dallas, Toronto, Kansas City, Lincoln Park, Point Defiance, and Columbus - we appreciate your dedication to AAZK! You helped us meet our Chapter Challenge

fundraising goal! We had seven enter in the \$300 challenge and three enter in the \$500 challenge. And the winners are: Hogle Zoo is the \$300 winner & will receive a complimentary hotel stay and registration. Dallas is the \$500 winner and will receive a complimentary registration. And a special thank you to the West Michigan Chapter who didn't have enough to enter either challenge, but managed to send a little something anyway- we truly appreciate it!

The Icebreaker will be aboard the Colonel Paddlewheeler on Sunday, 30 September starting at 7pm. Come join us aboard this beautiful vessel as we paddle around Offat's Bayou. What better way to get to know your fellow zoo keepers than to be confined on a boat with them, drinks, and hors d'oeuvre for three hours?

Are you bringing a Silent Auction item? Save space and send it in early, that way you'll have more room to bring items back with you. All the proceeds from the auction will go directly to AAZK. So think big (like Texas) - bring a lot and buy even more. Zoo keepers will buy almost anything, so don't be shy.

Our website is filled-to-the-gills with information! The latest hotel, airline, transportation, directions, schedules, exhibitor/vendor info, as well as abstract & registration forms are there and much more. Check out our PayPal® store, too. We have assorted animal painted items, conference registration, and exhibitor/vendor registration that can be purchased. See www.gcaazk.org

Did you know AAZK is turning 40 this year? What better way to celebrate a birthday than at the conference! Help make the birthday celebration memorable by sending us your photos of past conferences, Chapter events, fabulous members, and those great animals we all love to conference@gcaazk.org. You can also drop them off at registration and we'll give them back by the end of the conference. Questions? Drop us an email at conference@gcaazk.org or give us a call at 800/582.4673 x4105. See you next month at the beach!

Editor's Acknowledgements

There are many people to thank for their assistance in getting this special dedicated issue of *AKF* to press. First, my thanks to AAZK Vice President Shane Good for bringing about this collaboration between AAZK and Polar Bears International. Second, I wish to thank Barbara Nielsen, editor of PBI's newsletter, for her tireless assistance in providing material for this issue. Much of what you read has been written by Barbara although she modestly declined any byline acknowledgement. I also wish to thank Robert Buchanan, President of PBI, for his assistance when there were questions and for all of his help with acquiring the wonderful photographs included on many of the pages of this issue. I also thank PBI for their generous underwriting of this special issue. And finally, my thanks to all of the authors and photographers who so willingly provided their manuscripts and images for inclusion in this issue - some were original for this issue, some are being reprinted from the 2004 Polar Bear, Husbandry Conference, still others from our sister zookeeper organization, The Australasian Society of Zookeeping and their journal *Thylacinus*. We have done our best to make sure proper photo credit has been given - if we erred, let us hope it was on the side of the polar bears who are the real stars of this issue. Enjoy!

--Susan D. Chan, *AKF* Editor

Year of the Polar Bear

By Robert W. Buchanan, President of PBI

Polar Bears International is a field-based organization that spans the icy North where polar bears roam. While PBI believes that Arctic research is critical to the polar bear's survival, we are also convinced that educating the public is an equally important conservation measure—and that AAZK members are in the best position to reach millions of people and inspire meaningful change.

For that reason, PBI has declared 2008 the “Year of the Polar Bear,” with the zoological community serving as the public interface for the event.

The Year of the Polar Bear will take advantage of PBI's extensive resources to create the tools needed to help zoos become education centers on Arctic conservation. The idea is to make sure that individuals and communities—under the leadership of their local zoos and aquariums—actively understand and become involved in thinking globally and acting locally.

Currently, 35 zoos and institutions have signed up to participate in the YPB program. Almost all of them took part in a PBI-sponsored workshop held in Columbus, Ohio, this past March. These institutions have each been invited to send a student to PBI's Leadership Camp in Churchill during the fall polar bear migration. They will also be empowered with such tools as the following:

- A “visitor experience” enhancement cart that features polar-bear ear tags, satellite collars, regional maps, high definition footage, and a polar bear skull, fur sample, teeth, and claw.
- Participation in PBI's Distant Learning Program, which will allow zoos to facilitate live programs that link local schools with polar bear scientists out in the Arctic, surrounded by polar bears.
- Media coverage that will link these scientists via direct broadcasts to local TV stations, all of which will be facilitated by the participating zoo. Local news anchors will be given the opportunity to discuss conservation issues with these top scientists.
- A “National Teen Contest,” which will allow participating zoos to be part of a national competition. The contest will motivate teens to act on behalf of polar bears by effecting change in their local communities. The focus will be on planting trees, promoting the use of recycled materials, and finding various ways to save energy. The top teams will be brought to a North America gathering point, with the winners awarded trips to Churchill to see polar bears in the wild.
- A massive, multi-player online game that will immerse players in the majestic, harsh, and fragile world of the Arctic. Players will have the opportunity to choose various roles and will be faced with challenges to overcome. The game will be hosted on PBI's server with access through the Web sites of participating zoos.
- Participation in a Polar Bear Tour. Space has been set aside at the famous Tundra Buggy[®] Lodge during the peak of the polar bear migration season in Churchill. This will allow zoos to bring in groups without committing to a fixed head-count. Participants will not only be able to experience having breakfast, lunch, and dinner surrounded by polar bears, but will be part of a program where they'll have direct, one-on-one access to the top polar bear researchers in North America.

The Year of the Polar Bear will also provide a number of other elements for zoos committed to the program, such as:

- Having renowned polar bear scientists and adventurers lecture at their institutions
- Participating in a play space/maternal den exhibit
- Hosting lectures from indigenous peoples
- Receiving extensive educational materials
- Participating in an "Adopt-A-Den" program
- And taking part in extensive media coverage.

Ultimately, the Year of the Polar Bear will deliver a multitude of tools to participating zoological centers, with little or no financial investment on their part.

PBI is proud of this alliance with zoos at a critical time for polar bears. We believe that there are no more powerful and passionate individuals than animal caregivers. These dedicated individuals have the incredible ability to communicate their story to zoo visitors, as well as the unique skills to provide quality care for polar bears, our furry Ambassadors of the Arctic. AAZK members are the cornerstone of change, and we are honored to have them as part of our team.



Great Offer from Polar Bears Int'l for AAZK Members!

Polar Bears International is making a very generous offer to all AAZK members to become members of PBI at no cost! This offer will be available for the next two years! The regular annual cost of a PBI membership is \$25 and includes their quarterly newsletter, so this is a great value.

If you are interested in taking advantage of this opportunity, please email your name, complete mailing address and email address to:

Tiffany Mayo
tiffanyvarga@hotmail.com

If you do not have email access you may send your information to Tiffany Mayo, Cleveland Metroparks Zoo, 3900 Wildlife Way, Columbus, OH 44109, Attn: PBI Offer. Tiffany is a member of the Greater Cleveland AAZK Chapter and has volunteered to put together the mailing database of AAZK members interested in taking advantage of the free PBI membership offer

We thank Polar Bears International for their most generous offer and also for their support and underwriting the cost of this special dedicated issue of *AKF*.

Be A Part of PBI's
Year of the Polar Bear!
www.polarbearsinternational.org

El Photo Grande

The Big Picture. I remember a long conversation at the hospitality suite of my first AAZK conference. Several of us discussed the role of keepers within the Big Picture. For many of us our workday is a race against the clock to try and get all of our regular duties and projects accomplished. Cleaning, exhibit work, enrichment, training, cleaning, tour groups, education programs, cleaning, data collection, meetings, animal observations, veterinary procedures, cleaning ...You get the idea. But at the end of the day, what have we accomplished towards making a positive impact on the Big Picture, from conservation's point of view?

Two thousand-seven is an important year for all AAZK members. First, it marks the 40th anniversary of our professional association. It is also the year that many scientists confirmed that the earth faces a climate crisis of catastrophic proportions. What remains to be seen is whether 2007 was really the year that humans woke up to the reality that our actions put the health of our entire planet in jeopardy. I have reason for optimism. Suddenly, it seems, it's cool to be green. Actors, politicians, media, and rock stars are talking about the environment. I write this letter on the eve of Live Earth, the rock concert scheduled for all seven continents, designed to sound the alarm on global warming and launch a mass movement towards positive change.

Riding the crest of this wave is 2008 and Year of the Polar Bear. There is no greater icon for climate change than the polar bear, and no group better prepared to deliver its message than Polar Bears International and the members of AAZK. Together, AAZK and PBI are working as conservation partners on this very important project. Here's the big picture...

AAZK has 84 local Chapters and 2500 professional members. Our Chapters exist in over 200 accredited zoos whose collective annual attendance is over 140 million people. Combine this with our fellow members of the ICZ, whose membership includes nine national keeper associations and nearly 6000 members representing over 30 countries. Our community of zoo keepers has the potential to be a powerful force in conservation. Research has shown that the millions of people who come to our zoos prefer to hear conservation messages from zoo keepers. Research also shows that when it comes to the many ways conservation messages can be delivered, zoo visitors find the messages from keepers to be the most credible. Why? Because they recognize your personal connection with the animals under your care, and trust your educational message. As a keeper, no one is better suited than you for reaching out to all of those people.

Polar Bears International recognizes the importance of involving keepers in Year of the Polar Bear. They have sponsored this issue of *Animal Keepers' Forum* and your AAZK Board of Directors continues to work with them on many other exciting ideas.

You don't need to be a bear keeper to be a leader in Year of the Polar Bear. The climate crisis affects all of us, and all of the species we work with. Aquarists know warming seas, melting ice caps, and changes in ocean currents and sea levels will affect all marine life. Herpetologists know that changing weather patterns have resulted in the extinction of at least 112 amphibian species since 1980. Bird keepers know that increased summer temperatures in the Arctic are causing evaporation of ponds that are vital to the diets and nesting of migratory birds. We all need to get involved.

The Big Picture conversation in that hospitality suite, over a decade ago, had a profound effect on me. I soon became much more involved in my local AAZK Chapter, national AAZK committees, and conservation organizations. I'm hoping this issue of *AKF* inspires more conversations and involvement, in Year of the Polar Bear and within AAZK. One of my favorite things about PBI is their motto. **Inspire, Inform and Empower.** I hope this issue of *Animal Keepers' Forum* informs and inspires. If you're inspired enough, we're ready to empower you as leaders in conservation.

--Shane Good, Cleveland Metroparks Zoo
Vice President, AAZK, Inc.

Polar Bears International - What It's All About?

Robert Buchanan saw his first wild polar bear on a trip to Churchill, Manitoba, more than 20 years ago. "It was a life-changing experience," he says. "From that moment on, I was hooked on the bears and the Arctic."

Today the retired executive is so passionately committed to helping the great white bears that he volunteers full-time as the president of Polar Bears International (PBI), a nonprofit conservation group. Buchanan donates more than 60 hours a week to the organization, which is dedicated to conserving the bears through research and education.

"The polar bear scientists on our Advisory Council tell us that there is still time to save the polar bear," Buchanan says. "But they believe we have less than a decade to understand the consequences of Arctic climate change and take corrective action."



For that reason, PBI's dedicated volunteers—which include an array of talent ranging from zoo keepers and educators to scientists and wildlife photographers—all feel a sense of urgency in terms of helping the bears.

The primary threat to polar bears, says Buchanan, is the severe decline of Arctic sea ice—the bears' platform for hunting and feeding—due to climate change. Scientists predict that if present trends continue the Arctic could be ice-free in 40 years.

PBI is taking a two-pronged approach to ensure that the symbol of the Arctic survives into the next century. "First, with the help of the top polar bear scientists in the world, we've been able to identify the most pressing research projects in terms of helping the bears," Buchanan says. "We've dubbed these collectively 'The Polar Population Project' or 'Tri-P.' Through this work we'll be able to understand what geographic pockets in the North offer polar bears the best chance for survival."

Once these areas have been targeted, PBI will be able to work with governments and land management officials to make sure that the bears are completely protected in these sanctuaries. "This will give the bears a chance to repopulate if the warming trend can be reversed—which we believe is possible through technology and human determination to solve the problem," says Buchanan.

The second approach is PBI's intense focus on educating people to effect change on how they care for this planet. The organization's Web site, www.polarbearsinternational.org, draws millions of people every year, and its educational outreach includes such innovative programs as its Leadership Camp, Conferencing Classrooms, Polar Bear Cam, and In-Field Lectures.

"Our purpose is to inspire, inform, and empower people to make a difference," Buchanan says. He adds that PBI is an all-volunteer organization and that 100% of every donation goes straight to polar bear projects. "We're very proud of that fact," he says. "Our low overhead is covered by gift shop sales and board member donations."

In 2008, which the organization has designated the "Year of the Polar Bear," PBI plans to reach 138 million people with its message by working through a network of zoos.

"Time is running out for the polar bear," Buchanan says, "but it's not too late. We passionately feel that their groundbreaking campaign can not only heighten awareness, but motivate change forever."

And that, he says, is just what is needed to save the bears.



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Polar Bears International

2008 "Zoological Tour" in Churchill

The Tundra Buggy Lodge is the best situated accommodation in the world from which to view and photograph polar bears. During your three days with us in Churchill, embark upon the Tundra Buggy to explore the Hudson Bay Lowlands in search of the mighty *Ursus maritimus* and other abundant wildlife in the region including arctic hare, ptarmigan, arctic fox, gyrfalcon and possibly caribou. Capture a ringed seal with a polar bear in the same frame and this will officially be the trip of a lifetime.

This trip provides you a great opportunity to visit with and get to know others who share your passions, including two of the world's top polar bear scientists and other PBI special guests. As well, you'll receive first-hand access to PBI special projects including Conferencing Classroom, Robotic Cameras and the Polar Bear Cam on BuggyOne.



Evenings on the tundra are just as memorable as the days. Relax before hearty home-cooked meals then enjoy thoughtful and inspiring evening presentations. Keep in mind we'll be directly under the auroral oval; clear skies generally produce stunning northern lights.

This unique itinerary is brought you by Polar Bears International and Frontiers North's Tundra Buggy Adventure and is available only to guests with a zoological sponsor or zoological affiliation.

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Oct-26 - Oct-30 Tour codes 52 & 53

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Single supplement \$175 CAD

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- Continental breakfast at the Four Points Sheraton
- Early morning flight from Winnipeg to Churchill
- Interpretive transfer from the Churchill Airport to the Tundra Buggy
- Three full-days Tundra Buggy Adventuring
- Maximum 18 passengers per 40 passenger Buggy
- Three nights accommodations at the Tundra Buggy Lodge
- Interpretation and presentations by PBI special guests
- All your on-Buggy and Tundra Buggy Lodge meals
- Late afternoon flight from Churchill to Winnipeg, meal included
- Post-Churchill hotel night in Winnipeg at the Four Points Sheraton
- Maximum 36 passengers per departure

To inquire about or make your booking on one of these departures, please visit this web-page which will put you in contact with one of our qualified Adventure Planners. See www.tundrabuggy.com/pbi-2008/ or call 1 (800) 663-9832



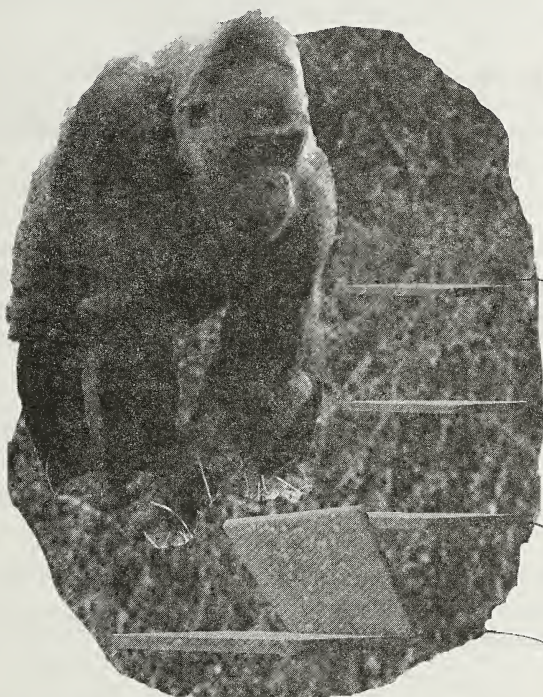


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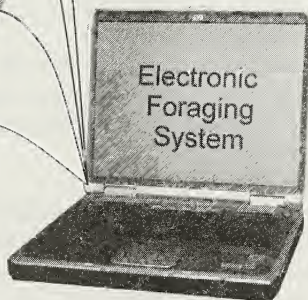
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Polar bear scientists believe that it's still possible to save polar bears and the Arctic, but the window of opportunity is only about ten years. Given the need to move quickly with conservation measures, PBI has declared 2008 "The Year of the Polar Bear" to help publicize the importance of conserving the delicate Arctic ecosystem. The year-long, worldwide event will feature a number of media events and programs, but the most important component will be a cooperative effort with zoos.

"Zoos have a tremendous ability to reach the public and thus play a key role in conservation efforts," says PBI's president, Robert Buchanan. "More than 30 of the top zoos with polar bears have signed on to help promote the Year of the Polar Bear and serve as centers for Arctic education. Our target is to reach 138 million people over the course of the year."

High Energy Sessions

PBI kicked off planning for the zoological component of the "Year of the Polar Bear" in March of this year at a workshop in Columbus, OH. The four-day workshop, which was organized and hosted by PBI, began with a day-long creative session with zoo educators and marketing directors. "We talked about how we wanted ideas and programs that would pull people into zoos and educate them while there," says Buchanan.

After an overview from PBI, the 80 to 90 delegates broke into smaller committees to brainstorm ideas. "We had no down time whatsoever," says Buchanan. "Everyone was so enthusiastic. They were focused on educating the public about polar bears and the problems they face in a warming Arctic."

The committees came back with 40 to 50 major ideas and the group chose 10 on which to focus. Participants then refined those concepts during the second day of the workshop, working under the leadership of Kathryn Foat of the Maryland Zoo, who served as chief facilitator.

Whiz Kids

On the third day, delegates presented their ideas to a high-powered think tank comprised of creative talent that included over a dozen corporate executives plus wildlife artists, graphic designers, and Web masters. The creative team—dubbed "the whiz kids" by Buchanan—then helped delegates tweak and fine-tune the ideas.

"The think tank was blown away by the strength of the ideas and programs," Buchanan says. "They coached the delegates on how to improve the concepts and also added some ideas of their own."

After receiving feedback, the delegates finalized the concepts and created forward action plans.

Final Products

The ideas that emerged from the workshop will be available for implementation in all participating institutions. They include:

☞ An "Adopt a Den" project that will allow kids to adopt a maternity den, thereby giving them a sense of ownership.

☞ A video and lecture series that will connect program attendees to native people who have been directly affected by Arctic climate change.

☞ A multiplayer online game that will immerse participants in the majestic, harsh, and fragile world of the Arctic. Players will be able to assume the role of a polar bear, an Arctic native, or an observer from a Tundra Buggy.

☞ Permanent enhancements to current polar bear exhibits. These range from an interactive video game to a hands-on display on the polar bear's sense of smell, hearing, touch, and vision. In addition, an immersion experience will recreate the beauty of the Arctic, help audiences understand climate change, and educate visitors about what they can do.

☞ A complete media campaign and tool kit for the Year of the Polar Bear, including a video, photographic images, press releases, and local tie-ins.

☞ A national "Teen Challenge" campaign that will inspire teenagers to act on behalf of polar bears in their local communities.

☞ An international "Call to Action Day" with activities and press materials.

☞ Distance learning programs that will link polar bear scientists and keepers with as many people as possible; each broadcast will be archived in an online library.

☞ A national "Year of the Polar Bear" speaking tour featuring PBI scientists, along with supporting materials.

☞ A "Polar Bear Play Space" that will include a replica of a maternity den among other ideas.

Institutions Participating in the Year of the Polar Bear

Alaska Zoo
Brevard Zoo
Brookfield Zoo
Buffalo Zoo
Cincinnati Zoo
Cleveland Zoo
Cologne Zoo
Columbus Zoo
Como Zoo
EAZA Bear TAG
Frontiers North
Indianapolis Zoo
Henry Vilas Zoo
Louisville Zoo
Manitoba Conservation
The Maryland Zoo
Memphis Zoo
Miami University Ohio
Milwaukee Zoo
North Carolina Zoo
Oregon Zoo
Partners in the Park
Philadelphia Zoo
Pittsburgh Zoo
Point Defiance Zoo
Roger Williams Park
San Diego Zoo
San Francisco Zoo
Scandinavian Wildlife Park
Sea World Australia
Seneca Park Zoo
Smithsonian's National Zoo
Texas A & M
Toledo Zoo
Toronto Zoo
Tulsa Zoo
University of Central Florida
Utah's Hogle Zoo
Wapusk National Park
Wildlife Conservation Society

Track the Bears Online

With the click of a mouse, visitors to PBI's website can now track satellite-collared polar bears as they hunt for seals on the ice of Hudson Bay and the Southern Beaufort Sea. Scientists with the University of Alberta and the U.S. Geological Survey transmit the data to PBI as they receive it. The graphics include information on the age of each bear and how many cubs she has.

Scientists only track female polar bears because the male bear's neck is as wide as its head, which allows the collar to slip off.



Researchers put satellite collars on polar bears to determine:



©Bob Wilson, PBI

- How far the bears roam and where they go.
- Their seasonal and annual movement patterns.
- How their movement patterns change in response to changing ice conditions.
- Information on where mother polar bears den and when they emerge with their cubs.

Satellite coverage will continue when the summer ice melts and the bears are forced ashore.

See (www.polarbearsinternational.org)

“Polar Bear Natural History”

*transcription of presentation by Steve Amstrup, PhD
Biological Resources Division, U.S. Geological Survey, Anchorage, AK
presented at the
International Polar Bear Husbandry Conference February 5, 2004, San Diego*

I'll talk specifically about Natural History phenomena that might relate to husbandry issues that many of you face with captive animals. So, I'll be talking about natural history features that you might contrast with some of the situations you have in zoos. I'll also be talking about how polar bears (*Ursus maritimus*) are different from some of the other members of the bear family. Also, I'm going to add some aspects of our research activities in recent years, because they add some depth and breadth to these other topics.

So what is a polar bear? The polar bear is the largest non-aquatic predator on the globe. Large adult male stands almost five feet high at the shoulder on all fours, can be almost 12 feet long, feet the size of platters, 45 or 50-inch neck. But like all members of the bear family, they start out small and vulnerable. Polar bears have a low reproductive rate and long reproductive cycle. They breed in the spring (March and April), but they have delayed implantation, so development is arrested after a few hundred cells until October or November, at which point implantation occurs. Birth is thought to occur – in the Alaska region at least – around the first of the year. The cubs stay in the maternal den until springtime (March, April) and then they remain with the female through their first and second years of life. They're finally weaned at close to three years of age, at which point they leave their mother and their mother is free to breed again. If a female is successful in bringing her brood through the weaning stage, she can breed no more often than every three years. So that's a pretty low reproductive rate.

Polar bear cubs grow rapidly. They emerge from dens weighing around 30lbs. (13.6kg), with males typically a little heavier than females. By the fall of the year, females weigh about 150lbs. (~68kg) and males a bit more. As spring yearlings, females weigh about 180lbs. (80.6kg) and males heavier. By fall, they are substantially heavier.

In the Beaufort Sea region, growth patterns are perhaps a bit different than they are in other regions. In the Hudson Bay area, for example, when the females come ashore in the summertime they don't have anything to eat. The ice is gone, the main food sources are gone, so they don't hit their peak weights in the fall. Typically, they're at their peak weights at the time they come ashore. In the Beaufort Sea, it's a much different situation.

As two-year-olds, they continue to grow and become pretty substantial creatures by this time in their life. One important thing to point out: Females generally stop growing in the 400-500lb. range (~182-227kg), whereas males continue to grow pretty much throughout their life. Females hit a certain weight that gives them enough mass to reproduce, and then once they hit that reproductive age, they pretty much stop growing. Males continue to grow pretty much throughout their lives, or at least until the age when they stop being competitive, which is around the mid-20s.

Distribution of polar bears is closely tied to the distribution of sea ice in the Northern Hemisphere. Wherever there's persistent pack ice for a major portion of the year we find polar bears. In Alaska, the ice penetrates down into the Bering Sea, often as far south as the Aleutian Chain. But when the ice retreats in the summer, most of the polar bears go with it. This is in contrast to the situation in the Hudson Bay, where the bay is covered with ice through the wintertime but then disappears entirely during the summer. As it disappears, drifting to the south, the bears are trying to stay on it as long as they can. As it melts entirely, the bears get off on the southern southwestern shore of Hudson

Bay where Churchill is, and that's where bears tend to congregate. The situation in Alaska is quite a lot different. This slide shows the distribution of ice in autumn 2002. The ice had retreated that year about as far north as it ever does and the vast majority of polar bears – indicated by these yellow dots – were on that ice. At that time, we had 3 radio-collared bears on the beach. Much different than Hudson Bay.

Polar bears are very much at home on this sea ice. They can swim very well. Sometimes swimming in the Arctic requires breaking a little ice. When it's too thin to walk on, but too thick to plow through with their chest, they can actually dive under the water and swim up to 30 yards or so holding their breath. They'll poke their heads up and breathe. I've seen them cross leads that are a mile or so wide, and every 30 yards or so they'll poke their head up to get a breath. Pretty impressive creatures.

The ice is where they'll find their mates, and sometimes where they'll enter maternal dens. Females with young select habitats that provide greater security for their young. Of course, the sea ice is also where polar bears find most of their nutrition.

Polar bears are probably the most mobile of all quadrupeds. We know this from radio telemetry studies that we've been doing recently. First, I thought I'd tell you about how we catch polar bears.

Because of their mobility and low density, they're very hard to catch. It's very difficult to follow them on foot. It's even more difficult to sneak up on them and give them an injection. We've come to depend entirely upon the use of helicopters to capture them. We hover helicopters over them at close distance so that we can shoot them with a projectile syringe. Sometimes they take more than one injection and after a few minutes they have difficulty standing up or following a straight line. Within about five minutes they lay down and fall asleep and at that point we move in and begin our work. We take a number of measurements, tag their ears, tattoo lips, take weight. The main thing I want to talk about is attaching radio transmitters to polar bears.



Dr. Steven C. Amstrup with polar bear triplets during a research expedition. (Photo courtesy of Dr. Steven C. Amstrup)

The advent of Effective Satellite Radio Telemetry Research has really been a boon to understanding the distribution

of polar bears. As I said, they are highly mobile; for example, we followed a bear for two years in an area over 300,000 square kilometers. We have had some animals with activity area up to 600,000 square kilometers, about the size of the state of Montana. So, they're extremely mobile animals. But they're also highly individualistic. Some animals are less mobile and we tend to call them "homebodies" for lack of a better term. For example, a bear in the Southern Beaufort Sea area occupied a much smaller area, far less than 100,000 square kilometers, over a two-year period. So there's a lot of individual variation and we never really would have understood that without Satellite Radio Telemetry. One of the things we can do with this data, which is a whole bunch of dots on a map, is depict their activity areas (or home ranges) with mathematical models that actually surround the cloud of points that represent their distribution. We've taken a look at the distribution of all of the bears, we've clustered them together, and determined that in this part of the world there are three different populations, or stocks, of bears. There's the Chukchi Sea stock, the South Beaufort Sea stock, and the Northern Beaufort Sea stock. One of the problems with this type of view of distribution

of animals is this tremendous area of overlap of the three populations. What good is it to describe three different stocks if they overlap so extensively? That, of course, is a considerable problem for wildlife managers who might need to allocate harvest to different villages or to understand the impact of an oil field development might have on a particular stock. So we've been developing a way to make these sorts of radiotelemetry data – which are always sort of a backward view of where bears have been, a retrospective view – more appropriate for real-time management decisions. One of the things we've been able to do is divide the study into a series of grid squares, and have been able to determine the relative probability of a bear in a particular grid cell being from a particular population. If you look from a bigger perspective, those grid cells, each with its own individual relative probability, convert into contour boundaries. So you can look at any place along the coast and say what the probability is of a bear being from one of those populations. This is very useful for harvest management among other things.

One of the ways that polar bears differ from other members of the bear family is in maternal denning. In polar bears, only pregnant females enter dens for the wintertime. With brown bears (*Ursus arctos*) and black bears (*Ursus americanus*), the whole population dens over the winter because the things that they normally eat are unavailable. Hibernation is a foraging strategy. In the case of polar bears, they eat seals that are available year-round. Pregnant female polar bears need to den in order to provide a secure environment for their newborn cubs. So denning in polar bears is purely a reproductive strategy. Another difference is that polar bears over most of their range den just in snow. Whereas black and brown bears might tunnel under trees or dig into the ground or occupy a hollow log, polar bears are surrounded just by snow and ice. They dig a snow cave in the fall of the year and subsequent storms cover them over.

Up until a few years ago, it was thought that Alaska didn't have much in the way of polar bear denning. In fact in 1980 there was debate between Russian and Canadian research scientists about who really "owned" Alaskan polar bears. At that time there had only been about 30 dens documented in northern Alaska. We turned again to radio telemetry to try and figure out where polar bears in Alaska were denning. By putting radio collars on pregnant females and tracking them to their dens, we were able to document that in fact Alaska has quite a few dens. Many dens were out on the drifting pack ice, which was kind of an unusual and unexpected discovery. From 1981-1991 – the first decade of our efforts to document – we found about 140 dens and within the last decade there appeared to be fewer bears denning on the pack ice and perhaps more denning in the westerly portion. Not clear why yet. One thing is for sure though, we have determined that we have polar bears denning in Alaska in adequate numbers to support the population.

We were interested in making the information about denning useful to management. It wasn't clear to us that describing where bears denned in the past would help predict where bears might den in the future. So we went out looking at the dens – after the bears had left, of course – crawled in, made measurements, etc. We visited the den sites after the snow left to see what the habitat looked like beneath the snow. We noted in many cases that there was evidence that a bear had denned there long after the bear had left. We found out that in Alaska, where the coastline is very flat, there's relatively little in the way of topographic relief and what relief there is lies in these bank habitats that occur mainly along coastlines, barrier islands, stream channels, and occasionally dry lake beds. Those are the places that polar bears choose to den. In the wintertime these banks get filled up almost entirely with snow, which is why they're attractive to polar bears. There's enough snow for them to construct a snow cave and create a den.

We worked with a cartographer to develop a map showing the distribution of highly probable polar bear denning habitat across a big chunk of northern Alaska. We're in the process of extending this both to the east and west. Having identified the places where polar bears prefer to den, we thought well, now, if we can figure out how to search those areas to see if there was a bear in a particular piece of that habitat, then we'd be in a really good position from a management standpoint, because we'd really be able to protect polar bear dens. We began to test whether we could see dens with

forward-looking infrared device. We hung it on the nose of a helicopter, and it creates an image. Light colors are warmer sea ice and the very dark areas are the big deep snow drifts. Those are the places we'd expect to find polar bear dens. On infrared, you could see a light spot in the middle of a dark area – that's the signature of a polar bear den as seen through infrared. One den that's actually open – and showed up very so bright – was actually empty - the bear had left the day before we came. But there was still enough latent heat in that den that it looked like a flashlight as viewed through the infrared. Some dens never appeared on infrared, or sometimes appeared and sometimes didn't. We determined several important factors for having dens show up, like temperature dew point, sunlight, and airborne moisture. The sun would raise the heat on the surface just enough so that it would erase the signature. Therefore, we just couldn't do it when sunlight was shining on the snow. We made some recommendations in a paper that appeared in the April '04 edition of *BioScience*, talking about how this technique might be used for protecting polar bear denning sites in the future. Knowing where dens exist can avoid inadvertent damage to a den area by human activity or other such problems.

Diet is another way that polar bears differ from most other members of the bear family. Whereas black bears and brown bears are omnivores, the polar bear is strictly a carnivore and a predator. In Alaska, a main source of food is the ring seal (*Phoca hispida*). Polar bears also eat bearded seals (*Erignathus barbatus*) and any other marine mammal they can catch. They catch their prey by sneaking up on them, hauling them out at leads or at breathing holes. There's been a sort of evolutionary war going on between polar bears and ring seals, where polar bears try every way they can to become more effective hunters of ring seals and ring seals meanwhile are trying not to be polar bear food. One thing that you see is that in the spring, when seals are hauling out to let their fur grow (they need to be warmed by the sun), they punctuate their basking by lifting their heads up to look around for polar bears, while also lifting their tails so that they can immediately smack down and push into the water if necessary. Another way that polar bears find seals in springtime is by searching for their undersnow lairs (below the snow, above the sea ice). Polar bears have become very adept at finding these caves.

Predatory lifestyle has its risks. There's always a chance for injury. Jaw injuries are probably fatal to polar bears. In the fall we caught a male that should have weighed around 1300 pounds and he was just emaciated. We couldn't figure out why until we opened his mouth to give him a lip tattoo and discovered that his maxilla was broken all the way through. He apparently had lunged at a seal, maybe hit his jaw on a block of ice, or maybe it happened while fighting. In the brown bear and black bear literature, there's plenty of evidence of bears breaking their jaws, having them heal (perhaps at odd angles), and then surviving the injury just fine. But with polar bears, the particle size of their food is such that without the ability of those canine teeth to penetrate down on the prey, the ability to forage is seriously compromised. We've never found evidence of healed jaw injuries in polar bears. So it's a good supposition that jaw injuries can be fatal to polar bears.

I want to take a minute now to look into the future for polar bears. We've made a lot of management progress dealing with many things, but one of the things that we really don't have much control over are the changes presently occurring in the sea ice habitat. We've seen a loss in the last 25 years of over a million square kilometers of sea ice in the Northern Hemisphere and people are predicting that this trajectory is going to continue. In northern Alaska that has meant longer periods when the ice has pulled away, and periods where the ice has pulled away farther than ever before. So you have situations where the waters near shore, which are most productive, are covered by ice for shorter periods of time. We're seeing far more polar bears in northern Alaska and this may have something to do with the retreating sea ice. We've also seen that because there are several places in northern Alaska where local native peoples harvest bowhead whales and butcher them right on the beach, there are a lot of whale remains right on the beach. We are studying and trying to understand the significance of whale remains in the diet of polar bears. We're also looking at how we can model sea ice use by polar bears to determine the kinds of ice that they prefer. If we can predict what the ice is going to look like in the future, perhaps we can predict what the polar bear distribution is going to look like.

One final comment. You'll remember that I said that the ice in Hudson Bay has always retreated entirely. Well, in the last couple of decades it's been melting a little bit sooner – 2 to 2.5 weeks earlier, on average. It's hypothesized that that's why females have been coming ashore at lighter weight and having smaller cubs. One thing we'll be watching for are similar changes in Alaskan waters. So far we haven't seen them. We may in fact be seeing some transient benefits to the warming phenomenon, but we know that if the sea ice continues to retreat, the benefits will quickly dissipate.

Question: Is there still debate about whether polar bears are induced ovulators?

Answer: I don't know for sure, but I've long assumed that they are. Don't know whether the data has been developed extensively enough to answer that conclusively.

Question: Is there sexual variance of "homebodies" vs. mobile bears? Do male bears tend to range farther than female bears?

Answer: All radio telemetry is from females, only because of the thick neck of the male, so we don't know the answer to that question. One small study that Dr. Steven Amstrup published in 1999 described movements of males. It was a very small sample size, but their movements didn't appear to be significantly different from females. Most mark and recapture information has suggested very little difference in movement patterns between males and females, which is very different from most terrestrial carnivores. But the ecosystem of the sea ice is also very different from land. Age doesn't seem to have anything to do with it either. More just individual idiosyncrasies.

Question: What about females with cubs?

Answer: Less mobile the first year compared to later. Bears with young cubs show a high level of activity but low level of mobility. Anyone with small children understands that.

Question: Breeding season is March-May, but does that include the time when males are squaring off? It's something we see in the captive population – males squaring off long before they're showing any interest in the females, and that happens prior to March.

Answer: Most researchers are not out there to know whether males are squaring off long before actual breeding. We're usually out there in March because that's the earliest we can get enough light and enough good sea ice. And we're usually off the ice by May. So, we're not out there earlier to know whether this is a pre-breeding behavior. However, the only time we see males fighting is when females are around. Otherwise, males avoid each other.

Question: Are we attributing change in denning distribution to global climate change phenomenon?

Answer: We haven't studied data thoroughly enough to ascribe an explanation yet. I wouldn't be surprised if changes in the conditions of the sea ice has made it less suitable for denning, but don't know for sure yet.

Question: Are there legal protections in place to know that once you have the data, companies will have to comply with protecting denning areas? Are there regulations to prevent interference with polar bear dens?

Answer: That is the hope of getting this information out and that appropriate action will be taken,

Question: Are the three populations that you listed genetically distinct?

Answer: No. Across the polar basin there is some genetic structure among polar bear populations. In the polar basin, there's very little genetic structure. We've done some limited surveys that show a few genotypes that are more common in some areas than others, but not statistically common. There are no geographic boundaries. The populations may be discrete from a management standpoint, but they aren't discrete from a genetic standpoint.

Vanishing Sea Ice

A dramatic time-lapse movie that depicts the rapid loss of Arctic sea ice from 1979 to the present can be viewed on PBI's website at www.polarbearsinternational.org< Dr. Ignatius G. Rigor of the Polar Science Center created the sequence based on satellite images and data gathered from buoys. Rigor is a research scientist/mathematician at the University of Washington in Seattle whose current projects focus on Arctic sea ice.

"The map covers 1979 to the present," says Robert Buchanan, PBI's president. "In the past, the polar bears of Western Hudson Bay were the exception to the rule—they were forced ashore each summer when the bay ice melted. Polar bears in other parts of the Arctic were able to keep hunting seals all summer. But this graphic shows that that is changing."

Rapid Decline

The animation features a map showing the Arctic Ocean rimmed by land, with Greenland to the right, Canada in the middle, Alaska to the left, and Russia and Norway above. The areas of older, thicker ice are shown in white. Younger, thinner sea ice appears as light blue; open water is deep blue. Red dots show the location of buoys that estimate the age of the sea ice.



Polar bear steps gingerly onto thinning ice.

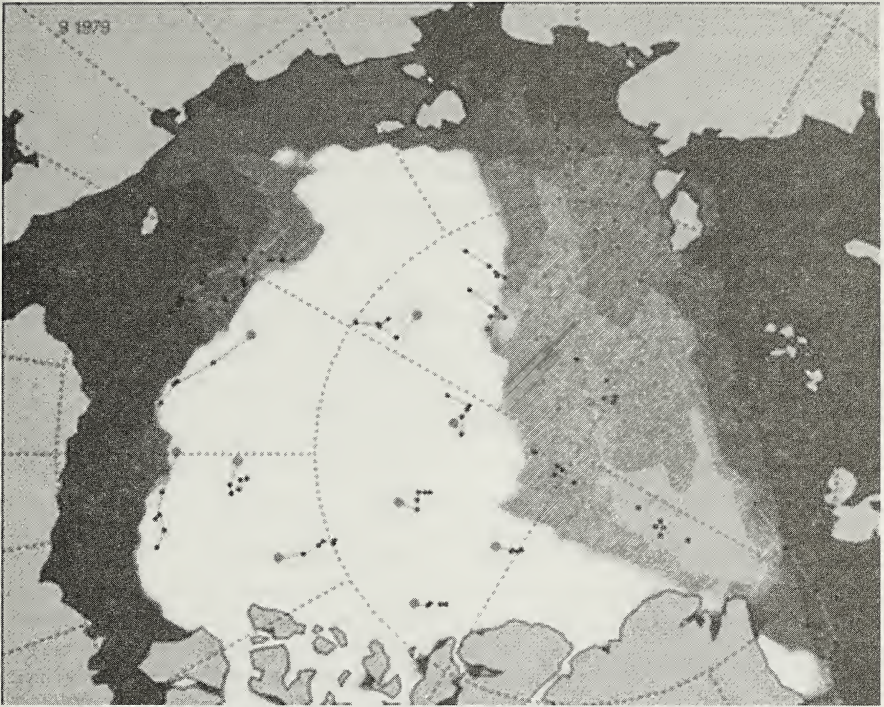
(Photo by R & C Buchanan)

The scientist explains that thick, multi-year sea ice is important to the stability of the Arctic ecosystem and helps keep the region colder. In contrast, younger, thinner ice melts more quickly. The graphic shows that multi-year ice decreased precipitously in 1989 and 1990 and has remained low ever since.

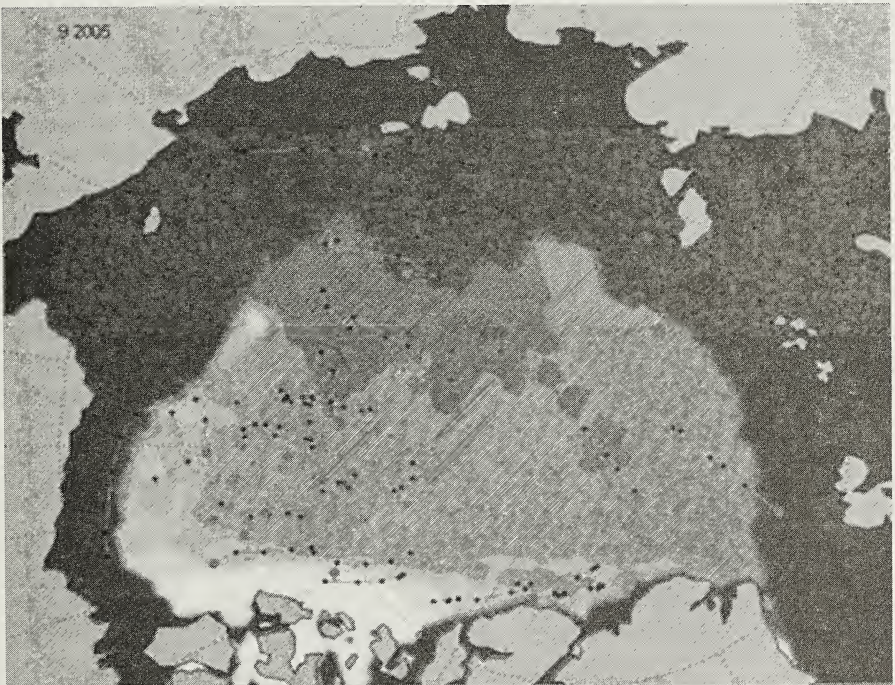
Fact-Based Information

"This map provides us with fact-based information on what is happening in the Arctic," says Buchanan. "It's important to remember that this is not a forecast—this is real. That's the key point here and that's why scientists are so concerned. We're launching the Year of the Polar Bear in 2008 for that reason. We're starting a movement that will change the way we take care of this planet."

The animation shows normal fluctuations in ice coverage from 1979 to 1989. But in 1989, the ice begins to rapidly shrink. By 2000, the amount of open water increases dramatically. At that point, the buoys flow east into the Atlantic with the older sea ice. The loss of the older sea ice is critical, Rigor notes, because the age of the sea ice accounts for more than half the variance in summer ice coverage.



The age and thickness of the sea ice has decreased dramatically since the 1980's



Today, there is more open water; more younger, thinner ice; and less older, thicker ice.

Ask the Experts:

Are Polar Bear Populations Increasing?

Answered by Dr. Andrew Derocher

Some recent media reports have cited inaccurate data concerning polar bears. They mistakenly state that polar bear populations are increasing. PBI turned to Dr. Andrew Derocher, a member of their Advisory Council, for clarification. Dr. Derocher is a polar bear scientist with the University of Edmonton in Canada and the Chair of the IUCN/SSC Polar Bear Specialist Group.

Question: The U.S. Fish & Wildlife Service has proposed that the polar bear be listed as a threatened species. Yet some news reports state that polar bear numbers are actually increasing. For example, the following paragraph appeared on the Fox News Web site:

“In the 1950s the polar bear population up north was estimated at 5,000. Today it’s 20- to 25,000, a number that has either held steady over the last 20 years or has risen slightly. In Canada, the manager of wildlife resources for the Nunavut territory of Canada has found that the population there has increased by 25 percent.”

If this is true, then why are scientists worried about population declines?



photo © R & C Buchanan

Answer from Dr. Derocher: The various presentations of biased reporting ignore, or are ignorant of, the different reasons for changes in populations. If I thought that there were more bears now than 50 years ago and a reasonable basis to assume this would not change, then no worries. This is not the case.

The bottom line here is that it is an apples and oranges issue. The early estimates of polar bear abundance are a guess - there is no data at all for the 1950-60s. Nothing but guesses. We are sure the populations were being negatively affected by excess harvest (e.g., aircraft hunting, ship hunting, self-killing guns, traps, and no harvest limits). The harvest levels were huge and growing. The resulting low numbers of bears were due only to excess harvest but, again, it was simply a guess as to the number of bears.

After the signing of the International Agreement on Polar Bears in the 1970s, harvests were controlled and the numbers increased- there is no argument from anyone on this point. Some populations recovered very slowly (e.g.,

Barents Sea took almost 30 years) but some recovered faster. Some likely never were depressed by hunting that much, but the harvest levels remained too high and the populations subsequently declined. M’Clintock Channel is a good example. The population is currently down by over 60% of historic levels due only to overharvesting. Some populations recovered as harvests were controlled, but have since declined due to climate-related effects (e.g., Western Hudson Bay). In Western Hudson Bay, previously sustainable harvests cannot be maintained as the reproductive and survival rates have declined due to changes in the sea ice.

At this point, we lack quantitative data for an overall assessment of trends in Canada or Nunavut as a whole. There is, however, very strong evidence for a decline in Western Hudson Bay and the Southern Beaufort Sea based on quantitative studies. More recently, scientists working in the Southern Hudson

Bay have reported a major decline in the condition of polar bears. A decline in condition was the precursor to the population decline in Western Hudson Bay. There is clear suggestion of a population decline due to over-harvesting in Baffin Bay, Kane Basin and possibly Norwegian Bay.

The point is that you cannot simply summarize the status of polar bears - the information lies in the individual populations. You cannot put the various time periods together into a simplistic overview. Sea ice is declining but again, it is not declining the same everywhere. Some small areas of multi-year ice may improve habitat for polar bears. This latter point, however, does not mean that the habitat in all areas will improve and the predictions are very clear that the primary habitat of polar bears is at risk.

We can control harvests through management and these efforts are underway for several of the over-harvested populations. So far, I have not seen any movement on serious consideration of reducing greenhouse gases in North America (or other countries with few exceptions). Climate warming is not under control and I do not see the management changes coming to effect the needed changes in climate change emissions.

Look at the messengers: lobby groups for big business say there is no problem. Yes, conservation groups moved the issue forward for listing under the Endangered Species Act, but this was already an issue that was founded on scientific information. The IUCN/SSC Polar Bear Specialist Group was moving on a Vulnerable designation (the same as Threatened under the Endangered Species Act) before anybody heard of actions from environmental groups. Sea ice change and habitat loss is the key driving force. Ignore the bears for a moment and look at the evidence for sea ice change: NASA is a key player in looking at the actual decreases in sea ice. It is an easy matter to put the dots together: no habitat, no seals; no seals, no bears. This never was an issue of polar bears alone. The only effective conservation approach is to protect the habitat and this is an issue of climate change. You can distort the issue any way you so desire. At the end of the day, the sea ice is disappearing. Take away the habitat and the species follows shortly thereafter (or before).

Comparing declines caused by harvest followed by recovery from harvest controls to declines from loss of habitat and climate warming are apples and oranges. Ignorant people write ignorant things.

Source: *Polar Bears International Website*: <http://www.polarbearsinternational.org/>

Polar Bear Status Report

The IUCN Polar Bear Specialist Group has released the proceedings from its 14th working meeting, which was held in Seattle in June 2005. The 198-page report contains detailed information on the status of polar bears and includes updated data from 2006. The proceedings also explore threats to the bears and report on current research projects and management issues.

The Proceedings PDF (198 Pages, 2 MB)
may be downloaded from the PBI website
<http://www.polarbearsinternational.org/>



PBI Launches Groundbreaking Study

Every year in late February, Dr. Nick Lunn travels to the Churchill area along Western Hudson Bay to work with female polar bears as they emerge from their dens with their cubs.

"Every spring we take a sample and check on the weight and condition of the mothers and cubs," the polar bear scientist says. "We also look at the age of the mothers, and we look at trends."

Lunn and his colleagues return to Churchill each fall to work with the region's bears again, this time capturing a larger sample that includes adult males. The scientists mark the tranquilized bears with ear tags and tattoos so they can identify them later. They also measure the bears, take samples, and determine their fat index.

Baseline Data

Due to their unique home range, the polar bears of Western Hudson Bay are the most-studied in the world. Every year, the population is forced ashore when the ice melts in summer, making it easy for scientists to conduct mark-and-recapture studies. Detailed data on the population dates back to the early 1980s, which is when Dr. Ian Stirling of the Canadian Wildlife Service initiated the project.

"Landlocked bears are much easier to count," says Lunn. "It's much more challenging when the bears are dispersed across the sea ice."

Because so much is known about the Western Hudson Bay population from capture-and-release studies—including fact-based data on how many bears there are—the scientists on PBI's Advisory Council decided that a comparison study with this group of bears would be the best way to calibrate a new aerial survey method.



The Ariel Transect Project will census females and their cubs as well as adult and subadult males in the Western Hudson Bay population. (Photo: R & C Buchanan)

Under the leadership of Dr. Nick Lunn, scientists plan to conduct aerial transect flights this fall to take a census of the Western Hudson Bay bears. They will then calibrate the results with the capture-and-release data available from the Canadian Wildlife Service. Once the results have been calibrated, scientists will be able to use the technique to help define polar bear populations in other areas.

"Current mark-and-recapture methods are incredibly difficult and expensive in terms of working with polar bears that are scattered across the sea ice," says Robert Buchanan, PBI's president.

"This is why we only have educated guesses—but no hard data—for many of the 18 managed subpopulations of polar bears. Yet census information, along with movement patterns, is vitally important in terms of the polar bear's ultimate survival."

Aerial Surveys

Being able to obtain accurate population estimates by aircraft will greatly speed up the process of counting the world's polar bears. It will also allow biologists to more easily obtain data in regions where the bears are more challenging to count—and they'll be able to do so in a noninvasive way. Scientists anticipate using the new method by 2008 as part of PBI's Polar Population Project.

"The point of the study is to calibrate the statistical information so that the margin of error is very thin," says Buchanan. "Once that has been done, scientists will be able to conduct aerial surveys throughout the Arctic with a great deal of confidence in the soundness of the results."

Preparing for the Flights

As with many of PBI's projects, this one involves a great deal of team work that spans international borders and agencies. Dr. Steven C. Amstrup of the U.S. Geological Service helped coordinate the team work on the project. Dr. Nick Lunn of Environmental Canada is spearheading the study, working closely with world-renowned statistician Dr. Trent McDonald of WEST Technologies of Wyoming. Wapusk National Park issued the necessary permits and Hudson Bay Helicopters will conduct the flights.

Lunn plans to conduct the study this fall during the peak of the polar bear migration along Western Hudson Bay. In preparation for the flights, however, the scientist is already working with McDonald on project details.



"We're in the process of drafting a map of the Churchill study area and spacing the transect lines that we'll fly," says Lunn. "After we've figured out the lines, we'll know exactly where to put fuel caches for use in the fall."

When fall arrives, two other biologists will join the team. Daryll Hedman of Manitoba Conservation and Dennis Andriashek of the Canadian Wildlife Service will count each polar bear that they see as their helicopter flies above the previously plotted transect lines. The data that they record will then be analyzed by McDonald, who will compare it with the figures obtained on the same bears through the capture-and-release method. McDonald has agreed to put the data-analysis on the fast track so that scientists can start using the new methodology as soon as possible.

"Time is running out as the Arctic continues to warm," says Buchanan. "Having fact-based information on *all* the world's polar bears is vitally important. The data will allow scientists to pinpoint the geographic pockets where polar bears might survive into the next century. PBI can then work with governments to ensure that those areas are completely protected."

Polar Bear Fast Facts

- A polar bear's home range can be enormous, far greater than that of any other species of bear. A single polar bear may rove across an area twice as big as the country of Iceland.
- One Alaskan polar bear was found to have a home range 45 times the size of Tennessee's Great Smoky Mountains National Park, which supports some 400 black bears.

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Dispatch from Russia

*Diminishing Arctic Ice Forces Polar Bears to Disperse —
and Requires Scientists to Increase Research and Conservation Efforts*

By Dr. Nikita Ovsyanikov and Dr. Irina Menyushina

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For all animals, population trends can be detected only through long-term research. For polar bears “long-term” means a time scale that spans decades and even centuries. Ideally, permanent monitoring of the species is needed. Why so?

Polar bears are large Arctic predators, with a long life span and low reproductive rates. Their life cycle depends on very large home ranges. Polar bears have evolved to feed on marine mammals and have adapted to live in an extreme and very specific environment. They have very specific requirements for giving birth and caring for their cubs in snow dens. For all these reasons, polar bears are highly vulnerable to environmental changes and human disturbances.



A landlocked polar bear patrols the coast of Wrangel Island. (Photo © Dr. Irina Menyushina)

Polar bears sit at the top of the food chain in the Arctic and serve as an indicator of the health of that ecosystem. As with other species, their welfare completely depends on the health of their habitat. Polar bears are vulnerable to environmental changes and cannot defend themselves against the direct and indirect impacts caused by humans. Neither can they move to other regions if their mother land—the Arctic—changes so drastically that living there becomes impossible for them.

To be able to conserve polar bears in a rapidly changing world, we need to know not only the basics of their biology, but the precise mechanisms of their living strategy and their limits for adjusting to



Diminishing ice is affecting the polar bears' ability to hunt.

(Photo © Dr. Nikita Ovsyanikov)

the environmental changes that they face. We also need to understand their population dynamics and to obtain solid information on their population status and trends. Without preliminary research of this kind, no sound monitoring can take place. Thus, our hope that we may help polar bears overcome the current situation of shrinking Arctic ice coverage can only be based on hard practical work, including population monitoring, the planning and implementing of conservation measures, and increased public awareness and support.

Accomplishments on Wrangel Island

We have been conducting research on the behavioral and population ecology of the polar bears of Wrangel Island for over 15 years, beginning in 1990. These bears are part of the Chukchi-Alaska population, which spans the U.S. and Russia.

Over the course of our study, we have collected a large body of data, including information on the polar bear's behavioral ecology. We have also gained a number of insights into the behavioral skills of polar bears that can be applied to their survival in a severe and highly variable environment.

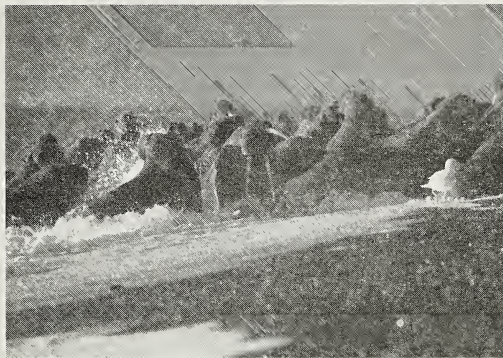
Through our research, we have learned that polar bears are highly social animals. They can easily switch from living as "solitary hunters on drifting ice" to socially tolerant members of large temporary bear congregations on the coast or sea ice.

We have also learned that walrus comprise a regular and essential year-round food source for polar bears. Our years of study and a few very well made wildlife documentaries have made polar bear-walrus encounters an established fact.

(Before 1990—when specific conditions brought together in one spot a large number of polar bears, a great crowd of walrus, and watchful observers—there was almost a complete lack of data on this subject in science and no understanding of the availability and importance of walrus as a basic food for polar bears.)



Dr. Nikita Ovsyanikov takes a census of polar bears along the coast of Wrangel Island. (Photo © Dr. Irina Menyushina)



Walrus haul-outs attract polar bears that regularly prey on them. (Photo © Irina Menyushina)

Our research has also documented the patterns of formation of polar bear congregations on shore and the importance of ice quality to the polar bear's foraging success. We have also significantly clarified many other aspects of polar bear behavioral ecology. One of our findings is that cannibalism in the polar bear community is a consequence of extreme conditions to which a population is exposed and an individual method for some bears, rather than a common feeding tactic of brutal males. In general, we have added significantly to our understanding of the actual mechanisms of the polar bear's social dynamics, which, in turn, is an important component of the polar bear's general population dynamics.

Changing Ice Conditions

Dramatic sea ice changes over the last few years on Wrangel Island have convinced us of the importance of broadening our area of research. Focusing on a segment of the population within a model area, such as Wrangel Island, is critically important in terms of detailed data and this research must certainly continue. However, in order to understand what is happening with the entire population, the geographical range of our research and its focus should be widened.

Our observations during the past few years on Wrangel Island and the comparison of reports on polar bear activity in different parts of the Chukchi-Alaskan population range led us to better understand the spatial distribution of the entire population during the critical autumn season. In the Chukchi-Alaskan sector of the Arctic, the influence of diminishing sea ice on polar bear habitats is much more pronounced than in the Canadian sector of the High Arctic. In fact, extreme ice conditions—that is, the full disappearing of ice within the range of the continental shelf—is being repeated in this sector almost every autumn.

For bears, the melting ice means that the population is seasonally split into several groups that are temporarily separated from each other. Each of these groups is exposed to some common and some specific threats and impacts. In the autumn of 2006, several dozen polar bears landed on Wrangel Island. Others came ashore along the northern coast of continental Chukotka, which is a dramatic drop from past years.

Due to the efforts of local native people—particularly brothers Vladilen and Sergei Kavri and the residents of the village of Vankarem—we know that in the autumn of 2006 about 200 polar bears concentrated near Vankarem Point, for a time spreading along a relatively short stretch of the coast line between the villages of Rirkaipyi (the Cape Schmidt area) and Nutepelmen (the Koluchin Bay area). Single bears were also recorded to the west and east of those villages. This means that the total number of polar bears surviving the ice-free season on the northern coast of Chukotka was hardly more than about 300 animals.

Another group of 200 to 300 polar bears landed on the northern coast of Alaska where they were monitored by our American colleagues. The rest of the population, as in the year 2005, drifted with the receding ice northward, to the Central Arctic Basin, well beyond the slope of the continental shelf. Where these bears dispersed and what impacts and risks they faced remains unknown.



Polar bear-human conflicts are expected to increase as more polar bears are driven ashore. (Photo © Dr. Nikita Ovsyanikov)

the village of Vankarem the native community is making an effort to manage polar bear-human conflicts without shooting the bears. Rangers regularly patrol the village and monitor bear activity, making residents (and polar bears) safer than in other communities. Sadly, we have also documented that poaching occurred in the autumn of 2006 in the Cape Schmidt area—we know that at least 5 bears were illegally shot, including a family group consisting of a mother with two cubs.

The specific situation with the Chukchi-Alaskan population calls for intensifying our research efforts and determining the most effective methodology for population monitoring. Without such methodology, we will not have objective information on which to base conservation and management decisions for the Chukchi-Alaskan population. There is a strong need for basic research on the polar bear population and behavioral ecology (this is particularly important in terms of detecting the influences of global environmental changes), for sound and well-coordinated monitoring of polar bear numbers and activity in

The Work Ahead

It is vital that we understand what happened with the bears of the Central Arctic Basin and that we continue to monitor the bears on Wrangel Island and the northern coast of Chukotka. In addition, we must increase educational efforts with villagers along the coast because more landlocked bears will inevitably lead to more polar bear-human encounters.

Those polar bears that land along the northern coast of Chukotka run a high risk of encountering people, which may easily result in a tragic ending for either side. In



Dr. Nikita Ovsyanikov's research cabin on Russia's Wrangel Island. The scientist has studied polar bears there since the 1990s. After the collapse of the Soviet Union, he was able to continue his work thanks to grants from PBI.

(Photo © Dr. Nikita Ovsyanikov)

the different sectors of the population range, and for the effective management of polar bear-human conflicts, which are expected to rise as more bears are driven ashore.

This year's research on Wrangel Island is supported by grants from the Columbus Zoo & Aquarium and Sea World Australia..

U. S. - Russia Polar Bear Treaty

A far-reaching treaty between the U.S. and Russia concerning joint management of their shared population of polar bears was overwhelmingly approved by the U.S. House and Senate last December and signed by President Bush. Congress has passed the legislation funding the treaty and giving the U.S. Fish & wildlife Service authority to act. The commission established by the treaty is up and running.

The treaty will make it possible for scientists to obtain accurate counts on the Chuckchi-Alaska population of bears, which is thought to have experienced precipitous decline due to retreating sea ice." Each year there are fewer bears on Wrangel Island because the ice isn't reaching the shore, said PBI's Chairman of the Board, Bob Wilson. Instead, more bears are showing up along the northern Russian coast where they're having encounters with villagers."

Knowing the size and health of the population, says Wilson, is the first step needed in order to develop a management plan. Twelve specialists from the U.S. and Russia met in September 2007 for preliminary discussions related to the Polar bear Treaty. The meeting took place in St. Petersburg, Russia, as part of the 7th International conference on marine mammals of the Holarctic. According to Dr. Nikita Ovsyankov of the Russian Academy of Sciences, who serves on PBI's Advisory Council, the delegates agreed that their main goal was to obtain objective and representative data on the shared population of bears.

"All participants clearly understood that decisions on the size of subsistence quotas and the necessary measures to conserve the population must be based on accurate data concerning the population's current status, health, and detected trends," says Ovsyankov. They all agreed that incorrect, or insufficient information could lead to wrong decisions and increase negative impacts on the bears."

The workshop outlines the process needed to develop a comprehensive monitoring program. To speed up the process, the polar bear experts who work with this population will increase the exchange of information and proposals. The group will meet periodically to assess progress and make decisions based on the data gathered.



A mother polar bear teaches her cubs how to defend themselves.

(Photo © R & C Buchanan)

Polar Bear Research in Zoos: An Interdisciplinary Approach

By

JoAnne Simerson, *Polar Bears International, San Diego Zoo*

Megan Owen, *Conservation and Research for Endangered Species, San Diego Zoo*

Since 2004 Polar Bears International (PBI) and the Zoological Society of San Diego (ZSSD) have been leading a collaborative effort to study polar bears (*Ursus maritimus*) in zoos. This mutual interest in polar bear conservation prompted the formation of an interdisciplinary team that included researchers from the Zoo's Conservation and Research for Endangered Species (CRES) and husbandry and training/animal care professionals from ZSSD's department of Collections Husbandry Science (CHS). Thus far three aspects of polar bear biology have been addressed by the ZSSD team: hormonal and behavioral changes associated with estrus, the role of olfaction in the social lives of polar bears, and the hearing sensitivity of polar bears. Although the data collected in these studies will aid in the management of zoo bears, they also provide invaluable insight into aspects of polar bear biology that may be impacted by current environmental trends, and so have implications for conservation of polar bears in the wild. Moreover, all of these studies would be logistically prohibitive, or downright impossible, in the wild.

Estrus Study: Hormones and Behavior

Little is known about the details of polar bear reproduction. Although captive breeding is not currently a conservation priority for polar bears, the lack of detailed knowledge on their reproductive cycle could someday be a detriment to conservation efforts. This research need prompted the initiation of the Polar Bear Estrous Cycle study in 2004. Researchers from CRES' divisions of Reproductive Physiology and Giant Panda Conservation collaborated with senior keepers from CHS to design the experiment and collect biological samples. To elucidate the physiological dynamics of the estrous cycle, two types of sampling were performed: 1) vaginal swabs were collected and analyzed for cytological changes in cell morphology that would be indicative of changing estrogen levels, and 2) fecal samples were collected daily and later analyzed for estrogen and progesterone concentrations. Concurrently, detailed behavioral study of the bears was initiated which would document both individual behavioral changes across the estrous cycle and any changes in social dynamics, both between males and females and females and females, during this same period.

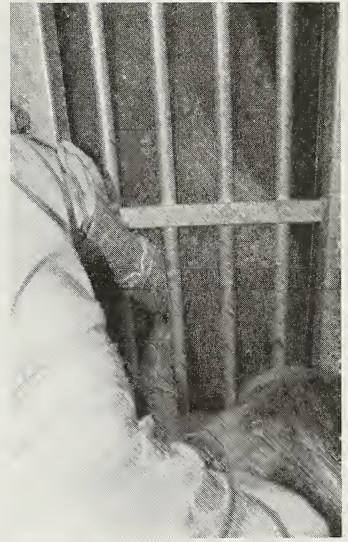


Dr. Tom Spady and JoAnne Simerson setting up for polar bear vaginal swabs and urine collection.

(Photo PBI/ZSSD Polar Bear Research Team)

Collecting vaginal swabs required training the bears to tolerate, (even enjoy!) sample collection. This procedure had previously been trained at the San Diego Zoo with a giant panda (*Ailuropoda melanoleuca*) and two Bornean sun bears (*Ursidae Helarctos malayanus*). The giant panda was most comfortable lying on her back, and the extremely arboreal sun bears were trained to sit on a platform and present their genital area. Polar bears are most comfortable lying in a sternal position but this does not allow access to the genital area. The bears were trained to line their rear ends perpendicular to a barred training door and to stand bearing weight on all legs. This gave the greatest amount of safety to the person swabbing. Once the bears were in the correct

position, cotton tip swabs were used to swab the vaginal walls for cell collection and gauze pads were used to collect urine scent from the urethral hairs (*see below: Olfactory Study*). The collection procedures took less than one minute. The vaginal swabs were rolled on glass microscope slides and sprayed with an ethylene glycol fixative. At the lab these slides were stained with a papanicolaou (PAP) stain, the same stain originally developed to identify pre-cancer cells in human females. This stain colors the vaginal cells as the steroid hormone estrogen rises and falls after ovulation. Fecal samples were collected daily and frozen for future analysis.



JoAnne doing a vaginal swab on polar bear at training panel.

(Photo PBI/ZSSD Polar Bear Research Team)

Both physiological and behavioral data are currently being analyzed. We expect that results will allow for more effective management of polar bears in situations where captive breeding has been proposed. These data may also be adaptable to work *in situ*.

Olfactory Study: Do Polar Bears Use Scent to Discriminate Between Sex and Estrus Status?

Having the bears lay still for vaginal swabbing allowed the ZSSD research team to collect scent samples from the bears' feet. The possible presence of pedal scent glands had long been postulated, but never confirmed. Even in the absence of such a gland, biologists who have observed polar bears in the wild, have noted how adult bears will sniff the snow-tracks of conspecifics and follow some of them, but not others. Specifically, male polar bears have been observed to follow the tracks of females known to be in estrus. The CRES team designed an experiment that took advantage of the assessment of estrus status from the vaginal cytology and collected pedal scent samples and urine from the females at various stages of estrus. Pedal scent and urine samples from the male were also collected. These



JoAnne and Kelly Murphy with female polar bear "Shikari" set up for paw swabbing.

(Photo PBI/ZSSD Polar Bear Research Team)

scent samples were then presented to our subject bears in a classic discrimination experiment. Two scents were presented simultaneously. In experiment 1, male versus female scent was tested; in experiment 2, estrus versus non-estrus female scent was tested. If the subject bear spent about the same amount of time investigating both types of scent, then we could say that they did not differentiate between male and female odors, or estrus and non-estrus odors. We also tested whether season impacted their interest in investigating, differential or otherwise, scents.

The bears were first trained to present their front paws for swabbing. The bears lay sternally and placed the

requested paw against the 2"x 2" wire mesh with toes spread exposing the inter-digit area of the front paw. The skin between the toes was swabbed with cotton top swabs to collect any secretion. The tops of the swabs were then sealed in vials for future chemical analysis.

The preliminary results from the pedal sampling were compelling and prompted the development of a more comprehensive olfactory study. For this second round of study we have proposed a larger number of study subjects and sample donors. Pedal scent samples will be collected by wildlife biologists from USGS from wild polar bears during the course of normal spring processing on the North Slope of Alaska. We hope to present these samples to a number of bears in North American zoos. Again, a classic scent discrimination experiment will be performed, but during these trials, polar bears will have olfactory access *only* to the scents. No gustatory or physical contact between the bear and scent sample will be allowed and thus preclude the possibility of exposure to zoonotic agents.

The goal of this work is to assess the importance of olfactory communication to the social lives of polar bears. If global climate change continues to reduce the volume and area of the Arctic sea ice, the polar bear's habitat will be fragmented greatly and scent trails will be disrupted.



Close-up of paw swab

(Photo PBI/ZSSD Polar Bear Research Team)

Hearing Sensitivity of Polar Bears

The success of the Polar Bear Estrous Cycle study prompted a request from USFWS to PBI: If you could train a polar bear to allow for vaginal swabs, could you train them to tell you what they hear? The controversial push to expand oil exploration on the North Slope of Alaska and into known polar bear denning areas increased the need for knowledge of polar bear auditory capabilities. The potential impacts of noise disturbance to wildlife are varied, and species-specific perceptual abilities can be very informative as to what types and intensities of noise may be disturbing. Currently, protective regulations prohibit most industrial activity within 1-mile of a known polar bear den. Results from the Polar Bear Hearing Study could be used to set the new standards.

In the most simple terms, doing a hearing test on a polar bear is no different than getting a hearing test in a doctors office. Of course, the logistics of working with a large terrestrial carnivore in a fairly noisy zoological-setting, render the execution of a study like this much, much more complicated. The scientific and logistical complexities of this research prompted the CRES research team to further expand the collaboration by enlisting the help of the bio-acoustic lab at Hubbs-SeaWorld Research Institute (HSWRI). The HSWRI team brought invaluable bio-acoustic expertise to the project which complimented the CRES team's expertise in bear ecology. The CRES/HSWRI collaboration has been essential to the execution of this project. Frequent discussions during project development with scientists from USGS Alaska were also a necessary, and invaluable, component of this project's development.

The research team designed a protocol for performing behavioral hearing tests on a total of four adult female polar bears at both the SDZ and SeaWorld San Diego (SWSD). The method of behavioral testing is time consuming and labor intensive but it is the "gold standard" for accurately determining hearing sensitivity. But before any testing could begin, we had to construct a quiet environment in which to do the testing. After many false starts we chose to dampen ambient noise in one of the polar bear facility bedrooms (the "Iso Room"). Using sound dampening materials, we covered all openings, skylights and doorways. Additionally, a sound dampened "tent" was created and set at one of the mesh doorways so that the keeper working with the bear was in the same quiet environment as the bear.

Training the bears for the testing was also full of trial and error. At first the bears were trained to touch a target with their tongue, but soon we saw that the best response would be a simple head shift to touch a target attached to the wire mesh. Accurate sound delivery also required that the bears



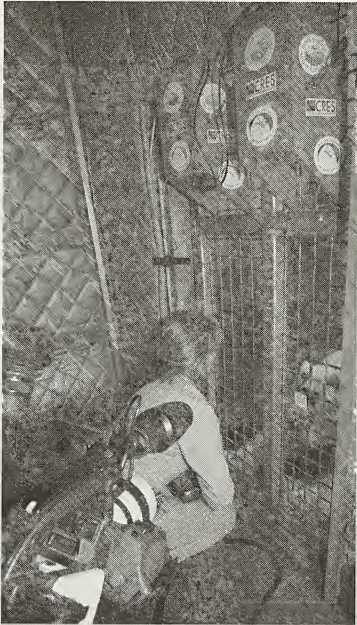
Close-up eye contact station for Hearing Study.
(Photo PBI/ZSSD Polar Bear Research Team)

hold their heads still and in the same forward position for every tone delivery. We decided not to have them station on a target but to have them maintain eye contact with their keeper. This would allow them to determine when they were willing to sit and also give them freedom to move during the most difficult and hard to hear tones. It is important to understand that the behavior being trained was not simply stationing and touching a target when a tone was played; the behavior that was being trained was *listening* and indicating when a tone was heard, generalizing from frequency to frequency and decibel to decibel.

For the SDZ phase of the project alone (testing was completed in April 2007), we delivered over 4,000 test presentations, varying in frequency from 150 Hz to 31.5 kHz. We are extremely pleased with the quality of the data we collected and we are now in the midst of analyzing the data. We are also happy with the enthusiasm the bears showed throughout the study. It was apparent that not only did they enjoy the eye to eye contact with their keeper, but as the tones became more difficult for them to hear, they showed increased focus and concentrated even more intently on the testing. Sessions were done four days a week and lasted approximately 15 minutes for each bear. The polar bears never refused a session and typically entered the sound dampened room with enthusiasm for the process. We are now moving to the second phase of the study by adding the adult female polar bears at Sea World San Diego to our sampling pool.

This study will provide fundamental data on the hearing sensitivity of polar bears and marks an important initial step in better understanding how noise from human activities may impact denning polar bears. Additionally, these data may provide information from which to design appropriate acoustic environments for polar bears in zoos and wildlife parks.

As we approach the assigning of a threatened status for polar bears the more information we can gain about this species the better prepared we are to help. Sharing knowledge from all disciplines is a fantastic way to get the job done quickly. Collaboration aids in brining it all together and defining the needs we all see to be filled. The participation of the zoos to help find answers to polar bear questions



Tent Set-up:

Camera recording session and tones, speakers attached to wire mesh, quilted sound dampening material, polar bear “Chinook” responding to tone by touching target; JoAnne maintains neutral position. (Photo PBI/ZSSD Polar Bear Research Team)

that can't be found with wild research is a statement of true ambassadorship to all of our animals' wild counterparts.



JoAnne gives Megan hand signal that a tone can be delivered; Megan watching for response from "Chinook"; "Chinook" responding to hearing the tone. Speakers are on mesh just out of the photo view. (Photo PBI/ZSSD Polar Bear Research Team)

The authors would like to acknowledge and thank the following collaborators and partners:

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USFWS/USGS: Steve Amstrup, Tom Smith, Scott Schliebe

BP Alaska: Bill Streever

PBI: Board members and Advisory Council

Polar Bear Fast Facts

- The polar bear's main prey is the ringed seal, the most numerous seal in the Arctic. Adult ringed seals reach an average length of 4.1 feet and weigh about 150 pounds. They are padded with a thick layer of blubber.
- When hunting is good, polar bears eat only the seal's blubber and skin. Younger, less experienced bears devour the remains, as do arctic foxes.
- Interestingly, scientists have found that when polar bears dine exclusively on seal fat, their cholesterol levels drop lower than those of fasting bears because of the protective quality of the omega-3 fatty acids found in the seals.

Busy Fall on the Tundra



Polar Bear (*Ursus maritimus*). A curious bear intrigued by the remote camera that was used to stream video by Polar Bears International. (All Photos: © Daniel J. Cox/Natural Exposures.com)

conferencing classrooms. PBI also had a team of in-field lecturers who boarded Tundra Buggies® to give informative talks about the bears. Finally, PBI hosted a popular lecture series in town with speakers including renowned writer and photographer Fred Bruemmer and polar bear scientist Steven C. Amstrup.

Cam Reaches Millions - PBI hosted this year's cam of the polar bear migration in cooperation with Frontiers North Adventures, National Geographic, SeeMore Wildlife, and WildlifeHD. The live cam was broadcast on the National Geographic Web site, with links to PBI. In addition, Apple's popular HD Gallery showcased high-definition highlights.

"The cam inspired millions of people to care about polar bears and the Arctic," says Buchanan, who was the driving force behind the effort.

Cinematographer Daniel Zatz, a four-time Emmy Award winner, manned the camera for six weeks, living and working on a retrofitted Tundra Buggy that served as a roving studio. He was joined by his wife, Lisa, and two-year-old son, Eli. National Geographic photographer Daniel Cox and his wife, Tanya, served as relief camera operators.



The Polar Bear Cam Crew, from l to r: Eli, Daniel and Lisa Zatz; Robert Buchanan; and Tanya and Daniel J. Cox.

"When Robert Buchanan first asked if I'd be willing to spend six weeks on a Tundra Buggy operating a Polar Bear

Cam, I thought it was the nuttiest idea I'd ever heard," Zatz recalls. "But then I realized that it would be a wonderful opportunity to spend time with some magnificent animals that might not even be here in 50 years. So I cleared my schedule and flew to Churchill."

Polar bears and tourists weren't the only ones to gather in Churchill, Manitoba, last fall. PBI had an active presence with an army of volunteers who helped educate the public about polar bears and conservation issues.

"You couldn't walk through the town of Churchill without running into one of our volunteers," says PBI's President, Robert Buchanan. "Their energy level was amazing."

PBI started off the season early with our Polar Bear Leadership Camp, which attracts top students to live and work on the tundra while studying polar bears. It continued with our Polar Bear Cam and video

Living with the Bears - Setting up a high-speed "autobahn" from the tundra was a technological challenge made more difficult by Churchill's remoteness. High winds destroyed 40 miles of wiring just one week before the cam was set to go live and a coding error added to the tension. But in the end, the team met its deadline. (For a fascinating glimpse into the work behind the scenes that made the cam possible, visit Daniel Cox's web site at www.naturalexposures.com/private/buggy_one.)

Zatz's son Eli proved to be an intrepid traveler. He turned the high-tech Tundra Buggy into a mobile playroom and took delight in the polar bears just outside, including the curious one that tried to bite the camera. His favorite was Dancer, a spirited male bear who liked to thump on the buggy at night.



NBC's "Today Show" traveled to Churchill to produce a segment on the bears. From l to r are: Al Roker of NBC and David Vaskevitch of Microsoft.

"At night we would hang blankets over the windows to keep out the cold," says Zatz. "

Then Dancer would come along and bang on the buggy. Eli thought that was so funny-he loved to lift the blankets to see him."

Despite one close call with a bear that nearly managed to open the door and get inside the buggy, Zatz is ready to repeat the experience next fall.

"I think it's important to raise awareness of climate change in the Arctic and how it affects polar bears-and the cam is a wonderful way to do that," says Zatz. "But next year, we really need to fix that door latch."

To view highlights from last fall's Polar Bear Cam, visit <http://www.polarbearsinternational.org/adventure-learning-polar-bear-cam/>

Polar Bear Scientists on Film

Polar bears and climate change are in the news these days, with a retreating ice pack and thinner polar bears causing concern. To help the public sift through the media reports and understand the changes in the Arctic, PBI has created a DVD called "In Their Own Words" in which key polar bear scientists discuss the bears and the Arctic ecosystem. The series is provided to educators free of charge as part of PBI's Polar Bear Awareness program. It is also available on the PBI Web site for viewing by the general public.

"We believe that these top polar bear scientists need to be heard so that people understand the challenges that face the Far North and polar bears," says Robert Buchanan, PBI's president.

Filmmaker Karen Berkman, producer and director of Light Fantastic Films in Australia, donated time and production expenses to interview the first two scientists in the series, Dr. Ian Stirling of the Canadian Wildlife Service and Dr. Andrew Derocher of the University of Edmonton. After the first DVD is complete, she will interview Alaskan scientists. Following are excerpts from the first part of the series.

Changes in Hudson Bay

Dr. Ian Stirling has been studying the Hudson Bay population for over 30 years. He notes that the average date of the ice break-up now takes place about three weeks earlier than it did before, leaving the bears with a shorter hunting season.

Stirling explains that the Hudson Bay bears are forced ashore each summer when the ice on the bay disappears. The landlocked bears spend the next four months living off their fat reserves. “The amount of fat that they’re able to put on is critical,” Stirling says. “If the ice breaks up earlier, they have a progressively shorter period of time in which to lay on those stores.”

He notes that cubs, subadults, and elderly bears are particularly vulnerable to a shorter hunting season. “There’s a direct relationship between the date of the ice break-up and survival,” he says. “One of the things that we’re finding is that the health—or condition—of the bears has steadily declined over the last 30 years.”

Stirling says that the Western Hudson Bay population has dropped by 22% since 1987. He predicts that unless the climate stabilizes or starts cooling again, there won’t be many polar bears left in the area in 30 or 40 years.

Drownings in Alaska

Stirling sees the Hudson Bay population as part of a larger picture of Arctic climate change. Beaufort Sea bears, for example, including the four drowned bears recently found off the coast of Alaska, are also feeling the effects of warmer temperatures.

The scientist explains that the minimum ice-to-land distance used to be about 100 kilometers (60 miles). “Now it’s 200 to 300 kilometers,” he says. “Swimming 100 miles is not a big deal for a polar bear, especially a fat one. They just kind of float along and kick. But as the ice gets farther out from shore, it’s a longer swim that costs more energy.

“The distance also leaves the bears more vulnerable. When there’s a lot more water, there’s a lot more fetch [surface area] for a storm to build up with big waves and rollers. The point is that the bears were out there in a big storm and what we saw is what we predicted would happen.”

Increased Encounters with Humans

The scientist also discussed the fact that more polar bears have recently been seen near human settlements along Western Hudson Bay, but says this doesn’t reflect a population increase.

“A starving carnivore doesn’t just lie down and die,” he says. “It’s going to look for an alternate food source. In Western Hudson Bay that means either garbage dumps, hunting camps, or, occasionally, people. Residents are seeing many more bears in West Coast settlements and that’s been interpreted as an increase in the population. In fact, it’s the exact opposite, as we know from analyzing our data.”

Derocher’s Viewpoint

Dr. Andrew Derocher echoed Stirling’s concerns about diminishing sea ice. “The ice is of key importance to the bears,” he says. “When you take away the habitat of an organism, you lose the organism. If we lose the sea ice, it’s pretty clear that we’re going to lose the bears.”

Derocher says that many people ask, “Well, if the ice melts, won’t polar bears become more like brown bears?”

His answer is that it took polar bears roughly 400,000 years to evolve from brown bears. “What we’re asking an animal to do—in the space of less than 100 years—is to turn back the clock and lose those adaptations and go back to being a largely plant-eating animal.”

Derocher says that it’s clear that climate change is happening in the Arctic, beyond Hudson Bay. “We know from projections from ice scientists and places like NASA that the ice has changed substantially, and projections are that it will continue to change and maybe at an accelerated rate,” he says. Still, he adds, no one really knows how quickly changes will occur and how widespread they will be.

What Can Be Done?

To save polar bears, Derocher says, humans need to change their behavior and leave a lighter footprint on the planet. "It's not really reasonable to expect people to make massive changes," he says. "We're looking at smaller, incremental things. Longer term, we really need to see new technologies that will lessen the impact that we have on a global scale."

Derocher believes that education is a major component of conservation. "If people truly understand the dangers not only to polar bears but to other animal species," he says, "I think they would change their behavior."

"I'm not yet to the point where I'm depressed," he adds. "I'm more at the stage where it's time to be concerned, where we need to help people understand the issues and to mobilize people to respond in a meaningful way. They can take very small actions like conserving gas in their vehicles or shutting off lights or turning down the thermostat. If everybody did those things, that would be a start."

Children, he says, respond to this approach. "I give lectures to elementary schools and quite often I tell the children to turn their lights off to help save polar bears," he says. "I know from their parents that their homes are now virtually dark because the children are keen to initiate change that will help polar bears."

Derocher believes that governments and industry also need to play a role in developing reasonable alternatives to fossil fuels, although the call for policy change will probably have to come from the bottom up rather than the top down, with citizens contacting their governments to request change.

"At the end of the day, I'm an optimist," he says. "I'm a great believer in the advances of technology. I think the answers are out there. We just have to find them."

Polar Bear Fast Facts

- The word "Arctic" comes from the ancient Greek *Arktikos*, or "country of the great bear." Though the Greeks had no knowledge of the polar bear, they named the region after the constellation *Ursus Major*, the Great Bear, found in the Northern Sky.
- Polar bears know how to pack on the fat: A single bear can consume 100 pounds of blubber at one sitting.
- A thick layer of blubber (up to 4.5 inches thick) provides polar bears with such excellent insulation that their body temperature and metabolic rate remain the same even at -34°F. A polar bear's body temperature is 98.6°, which is average for mammals.
- Polar bears have more problems with overheating than they do with cold. Even in very cold weather, they quickly overheat when they try to run.
- To beg food from another bear, a polar bear will approach slowly, circle around the carcass, and then meekly offer a nose-to-nose greeting. Bears who observe proper manners are frequently allowed to share a kill.

The Effects of Diet Change on Skin and Coat Condition of 1.1 Polar Bears (*Ursus maritimus*) at The Maryland Zoo in Baltimore

*By Becky Lynagh, Animal Keeper
The Maryland Zoo in Baltimore*

The Maryland Zoo in Baltimore is home to 1.1 polar bears (*Ursus maritimus*), "Magnet" and "Alaska". Magnet has been a resident of The Zoo since 1990 and had exhibited patterned hair loss for most of his life, especially during summer months. His condition had been monitored by keepers and veterinarians for years and he'd been treated with a variety of medications (i.e. prednisone, Benadryl). Despite all of our efforts, he continued to show signs of itchiness, eventually rubbing a large bald patch on his lower back. Alaska came to The MZIB in 2002. By 2003 she had also begun itching and rubbing off her fur. Unfortunately with her it was not just a patch, it was a majority of her body.

Captive polar bears have been historically fed as "adaptable omnivores" out of convenience and lack of knowledge about their specific nutritional needs. The Zoo's bears received an omnivorous diet that included large amounts of produce, most of which the bears did not eat. In an effort to decrease the amount of wasted produce, keepers proposed to offer the bears only produce items that they readily consume. This proposal lit a spark and keepers began research to change the bears' entire diet.

Below is the old diet that was offered to 1.0 Polar Bear:

Food Item	Amount Offered
Mazuri Omnivore Chow	1.14 kg.
Purina Dog Chow	0.45 kg.
Dallas Crown horsemeat	2.27 kg.
Mackeral	1.82 kg.
Lard	0.91 kg.
Apple	0.91 kg.
Carrot	0.45 kg.
Chunk Horsemeat (Mondays only)	2.27 kg.
Knuckle Bone (2x/week)	1 bone

Three days a week he also received 1.36 kg. of produce in addition to the diet listed. The female polar bear received a similar diet in smaller amounts.

Many zoos are beginning to offer their polar bears more carnivorous diets. Polar bears are naturally designed to consume high fat, low protein diets. In 2004 we decided to switch the polar bears from a high protein, low fat diet to a high fat, low protein diet. The new diet as a whole was more meat and fish based, with the bears only receiving only a small amount of produce daily as enrichment.

The following is the new and improved diet offered to 1.0 polar bear:

Food Item	Amount**
Mazuri Polar Bear Chow	0.91 kg.
Nebraska Carnivore Diet	4.54 kg.
Mackeral	1.82 kg.
Herring	1.82 kg.
Knuckle Bone (3x/week)	1 bone
Thiamin-E supplement	9 grams.

**This is the maximum amount of food offered



0.1 Polar Bear, "Alaska" before the diet change (2003)

(photo by Chris Bartos)



0.1 Polar Bear, "Alaska" after the diet change (2004)

(photo by Becky Lynagh)

As with their previous diet, the female polar bear receives a diet similar to the one listed except in smaller amounts.

With the new diet, the amount of food offered to the bears fluctuates four times throughout the year according to their activity levels. The bears tend to be less active and sluggish during the Summer months so their diets at that time are significantly smaller than their diets in the Autumn and Winter months. Also, the female's diet is changed frequently throughout the Autumn and Winter to cater to her denning needs.

After speaking with several polar bear keepers and nutritionists we discovered that our new proposed diet was very similar to those offered in other zoos. The missing component was an effective nutritional supplement. While many zoos utilize cod liver oil, we learned that two necessary supplements for captive polar bears are Vitamin E (200 IU/day) and Thiamine (50 mg/day) (Kleiman et al, 1996). Diets that are high in fat produce a greater risk of fat oxidation, which results in the release of free radicals (Kleiman et al, 1996). Free radicals are volatile molecules that destroy tissues. Vitamin E is a proven antioxidant and has been shown to prevent fat oxidation in Vitamin E deficient animals (Cheville, 1999). Vitamin E has also been linked to muscle, brain, skin and reproductive functions (Cheville, 1999). Thiamine is an important enzyme component of the nervous system (Cheville, 1999). Certain species of fish release a thiaminase, which can deplete the thiamine reserve in an animal (Kleiman et al, 1996). Without proper supplementation, thiamine deficiency could occur which could lead to metabolic and/or neurological disease (Cheville, 1999).

The bears' diets were changed in 2004 November and the positive effects were seen almost immediately. After only a week their stools were nice and formed (something only a zookeeper can be excited about). A few months later both bears began to fluff up and had full fur coats.

The true test came in 2005 May (the usual allergy/hair loss season). To our delight both bears maintained

their full coats. We also observed little to no scratching or rubbing. To date we only see the bears rub and/or scratch when shedding out their thick winter coats.

Our new and improved diet, in conjunction with better water quality and a new exhibit, have proven to be more beneficial than we had ever imagined. What started as an effort to decrease wasted veggies has become a life-changing accomplishment for both the bears and their keepers. The bears are now healthier than they've been in years and enjoy daily compliments from staff and guests.

We would like to give a special thanks to the following people who helped make this diet change possible. Thanks for all your guidance and advice! Thanks to: Michelle Shaw, MSc. (Toronto Zoo), Lorraine Smith (North Carolina Zoological Park), Cindy Kreider (Erie Zoo), Tom Granberry (Indianapolis Zoo) and Dr. Ann Ward (Fort Worth Zoo).

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Nutrition Handbook Download

<http://www.polarbearsinternational.org/pbi-supported-research/nutrition-handbook/>

Thanks to a series of workshops funded by PBI, a comprehensive manual on the nutritional needs of captive polar bears is now available free of charge on the PBI Web site. The 66-page document covers everything from the basic dietary needs of captive bears to sample menus. "People have been anxious to get this information," says Barbara Lintzenich, chair of the American Zoo Association's Nutrition Advisory Group (NAG) and team director of the project. "They're very pleased by how detailed it is."

Five nutrition experts worked as a team to write the bulk of the document. In addition to Lintzenich (Cincinnati Zoo), the five main authors include Ann Ward (Fort Worth Zoo), Dr. Mark Edwards (National Zoo), Dr. Mark Griffith (Purina Mills), and Dr. Charlie Robbins (Washington State University). Kerri Slifka and Krista Jacobsen of the Brookfield Zoo contributed a chapter on the nutritional needs of hand-reared cubs.

"We decided to fund this initiative after PBI's International Polar Bear Husbandry Conference highlighted the fact that there were a lot of unanswered questions about captive polar bear nutrition," says Robert J. Wilson, PBI's chairman of the board. "Our goal was to produce a manual with in-depth guidelines."

Team members met four times after the 2004 conference to work on the project. At the first meeting, in April 2004, they outlined the basic questions to be answered and parceled out the work according to expertise. They shared their findings at the second meeting and identified areas of the document in need of fine-tuning. At the third meeting, they reviewed those findings before compiling the information into one huge document, which they pored over for accuracy, line by line. Dr. Randi Meyerson of the Toledo Zoo, who chairs the American Zoo Association's Polar Bear Species Survival Plan (SSP), says that the manual not only provides guidance about what to feed captive polar bears, but covers different feeding methods that can stimulate the bears psychologically.

"The SSP felt really fortunate to be able to partner with PBI on this," she says. "It's an important document that meets both physiological and psychological needs. We all want what's best for the bears."

Now that the nutrition manual has been completed, Robert Buchanan, PBI's president, says that the organization plans to fund a series of workshops on polar bear fur. "That's another area of concern with captive bears," says Lintzenich. "Some zoos have solved fur problems [for example, fur loss or thinning] through diet. In other cases, fur problems turn out to be a water-quality issue or a hormonal issue. We'd like to look into all these factors."

Formulating Diets for Polar Bears in Captivity

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presented at the International Polar Bear Conference

February 5, 2004 in San Diego, CA

Development of a nutritionally complete diet for polar bears in captivity includes consideration of: feeding ecology, gastrointestinal tract characteristics, species specific requirements, known requirements of domestic models, physiological state, environment/management considerations, and the foods available. Researching these categories and compiling data will allow the best diet in captivity to be offered.

The polar bear, the most carnivorous of the Ursidae family, prey primarily on ringed seals (Best, 1985; Derocher, et. al, 2000; Stirling and Archibald, 1977). Other seal species (bearded, harp), some whale species (white, narwhal), walrus, reindeer, sea birds, carrion, and vegetation have been reported as consumed (Derocher, et. al, 2000; Derocher, et. al, 2002; Knudson, 1978; Russel, 1975; Smith and Sjare. 1990). Consumption varies depending on the season and location. Some bears prey on seals year round as long as the ice has not receded (Derocher et. al, 2002). In locations where ice recedes some bears may be restricted to land for periods as long as 6 months where food is limited (Knudsen, 1978). Though bears prefer the energy rich blubber of seals, whole carcasses still contribute to the overall diet and may be especially important to subadults and orphaned cubs (Stirling, 1974).

The stomach of Ursidae is simple; the distal segment of their intestine is marked only by an appearance of mucosa with no cecum present (Stevens and Hume, 1995). Similar to other carnivores, polar bears have high digestibility coefficients for protein and fat, (Best, 1985). Their simple digestive tract is well suited for their highly digestible diet. No species-specific requirements are known for polar bears. Controlled studies necessary to determine the requirement for a specific nutrient are difficult to conduct with many captive wild species. However, energy requirements have been estimated and appear to be lower than those of large cats (Best, 1985). Other research has shown that although polar bears have higher vitamin A stores than other species (Leighton, 1988), this does not necessarily indicate a higher requirement for vitamin A. High vitamin A stores may be an adaptation to the high level of vitamin A in the natural diet. Since controlled studies have not been conducted, serum nutrient parameters collected from healthy free-ranging animals may provide data from which to assess captive animals (Kenny et. al., 1998). Additionally, a database on these levels in healthy captive animals can be useful in assessing diet adequacy (Crissey et al., 2001). (When assessing serum nutrient data it is important to consider if nutrient then reflects stores or diet recently ingested, sample size, appropriateness of methods, seasonality of samples, and diet ingested.

Due to the lack of species-specific data, it is reasonable to consider the known requirements of related domestic animals. Domestic models have been studied in great detail, and thus provide a database from which to extrapolate. A range of probable requirements can be established for polar bears based on animals with similar feeding ecology and gastrointestinal tracts. Domestic cats and dogs are used as models for polar bears (NRC, 1986, NRC, 1985, AAFCO 1999). Cats are considered strict carnivores and dogs omnivores. Polar bears are primarily carnivorous with vegetation as a minor portion of the diet (Knudson, 1978; Russel, 1975). Consequently a range of nutrient levels encompassing both feeding strategies is appropriate for formulation of captive polar bear diets.

Physiological state of the polar bear is another consideration in diet formulation. Captive diets can be tailored for pregnant, growing, lactating, thin, or obese bears. Diets also can be assessed for seasonal changes. Management considerations (training, group feeding/competition, exhibit design/enrichment) should be factored into the diet to ensure consumption of a nutritionally complete diet.

The diet items polar bears consume in the wild are not available for feeding in captivity. The nutrient content of the natural diet, if appropriate considering captive conditions, can be mimicked with items available to zoos. It is the nutrients, not the package they come in, that should be considered. Various food items such as nutritionally complete foods, meat mixes, marine products and produce, when fed in combination, should result in nutrient levels that meet the probable requirements. Nutrients in items that are commercially available may vary depending on the location and time of year. Fish is often a large part of many polar bear diets. The nutrient content of fish can vary greatly (Bernard et al., 1997). Consequently, regular analysis of diet ingredients and diet review are imperative to offering appropriate diets.

As directed by the BEAR TAG, a survey of diets offered and consumed by captive polar bears across seasons took place from 1996 — 2000. The survey was completed by seven zoos. It involved a bear data sheet, a questionnaire and a four day intake study. The bear data sheet asked about age, sex, weight/body condition, and physiological state. The questionnaire asked about enclosures, environments, health (example - coat condition), and stool quality. The four day intake study involved weighing the food in and food out each day in order to compare intake to offered. The survey revealed a large range in diets consumed and consequently nutrient levels. Nutrients levels consumed across seasons overlapped. Thus the overall mean across all seasons is presented. Nutrient content of diets consumed on a dry matter basis was (mean \pm standard deviation) 42.08% \pm 9.05 crude protein, 3.31% \pm 1.51 crude fiber, 19.29% \pm 6.34 crude fat, 2.20% \pm 0.63 calcium, 1.46% \pm 0.19 phosphorus, 31.60 IU/g \pm 18.37 vitamin A, 2.83 IU/g \pm 1.33 vitamin D3, and 271.65 mg/kg \pm 96.99 vitamin E. Most diets consumed met or exceeded the probable nutrient range for captive polar bears. Study animals have good coat condition. Stool condition varied from well-formed to soft.

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Roundworm Infections in Polar Bears

*By Jordan Schaul, MS, Ph.D., DVM Candidate
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The primary reason roundworm infections are so common in captive bears is that it is nearly impossible to eliminate ascarid ova (eggs) from an enclosure once the parasite has been introduced into the captive environment. Hence, generations of bears born in an ascarid-contaminated enclosure may become infected with roundworms. Despite strict quarantine protocols, a bear may test negative upon fecal sample examination and be subsequently reinfected upon exposure to roundworm eggs in an exhibit or holding area. Natural and "naturalistic" enclosures impede efforts to clean and disinfect living spaces and, in many cases, permit saprophytic pathogens to persist in the environment. Porous gunite and concrete exhibits may be easier to clean, but even they are difficult to decontaminate. The eggs of the roundworm can survive for years and are resistant to most disinfection agents. Although it is difficult to eradicate roundworms from a bear collection or eliminate them from an enclosure, adequate sanitation and antihelminthic administration can significantly reduce roundworm infections.

Keepers working with multiple species of bears, including polar bears, may agree that roundworm (ascarid) burdens are particularly prevalent in polar bears (*Ursus maritimus*). I found this to be the case given my own experience working with several individual bears, representing multiple species of bears. Curious if polar bears were indeed more susceptible to roundworm infections than other bear species, or if a discrepancy in the management of different bear species could explain patterns of parasitism, I set out to explore the problem of roundworms in captive bears. Through submission of a husbandry survey to 123 zoos and diagnostic study of fecal samples from a selection of these zoos, I found that polar bears and sloth bears (*Melursus ursinus*) were significantly more likely to be infected with the ubiquitous roundworm of bears than other bear species. The myrmecophagous sloth bear may be susceptible to infections because of digging and feeding behaviors that predispose them to exposure to saprophytic pathogens more so than other bears. Perhaps their long coats may serve as fomites for parasite eggs more so than the coats of other bears, as the eggs cling to hair fibers. These are just a few hypotheses that may contribute to the patterns of parasitism observed in captivity.

Polar bears were often administered antihelminthics more frequently than other bears within a collection, suggesting that parasites were considered more problematic for polar bears. Despite the high prevalence of roundworm infections in polar bears, it is difficult to explain these patterns. The ecopathology of ascariasis in wild polar bears suggests that exposure to roundworms may be limited in nature. There are fewer paratenic (intermediate) hosts that perpetuate the life cycle of the roundworm. In other words, the bears consume a spectrum of prey that are not likely to harbor infectious larval stages of roundworms. Therefore, polar bears are relatively naive to roundworm infections. Perhaps in captivity, they demonstrate much less resistance to the challenge of roundworm infections than other bear species as a result of limited exposure to the parasites. In essence, they have not co-evolved with the roundworm to the degree other bear species have.

In years past, an effective means of disinfecting a bear grotto was to apply a flame torch to the entire surface of the bear enclosure. This is no longer practical for exhibits with mixed substrates and enrichment devices. The best means for decontaminating an enclosure is to use a bleach solution which removes the outer shell of the parasite eggs, rendering the embryonated eggs vulnerable to the environment, and hence, easier to sanitize.

Some of the *Baylisascaris* species of roundworm, including those of the skunk and raccoon are confirmed zoonotic parasites. Although, *Baylisascaris transfuga*, the bear roundworm is not currently considered to be a zoonotic pathogen, it would be wise to use caution when working around bear scat.

Polar Bear Fast Facts

- Polar bears are the world's largest land predator. They top the food chain in the Arctic where they prey primarily on seals.
- Adult male polar bears weigh from 775-1500 lbs; females are smaller and weigh from 330-550 lbs.
- Polar bear's Latin name, *Ursus maritimus*, or "Sea Bear" refers to the animal's close association with the Arctic's chilly waters. It is the only bear considered a marine mammal.



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Living 'Green' Helps Polar Bears and All Living Things

Reducing carbon emissions is a good insurance policy for the health of our planet. Polar bear scientist Andrew Derocher says that even small changes can make a difference if each of us helps. Here are some tips from the Environmental Protection Agency (EPA), Natural Resources Defense Council (NRDC), and www.keepwintercool.org on how to curb greenhouse emissions by reducing energy consumption.

Power Down and Clean Up

If you replace your current washing machine with a low-energy, low-water-use machine you will be able to reduce your carbon dioxide emissions by 440 pounds per year. For even more savings wash your laundry in warm or cold water, instead of hot. That will reduce carbon dioxide emissions by about 500 pounds per year.

Keep Your Water Heater Cozy

For a water heater more than five years old, wrapping it in an insulating jacket will result in a 100-pound reduction of carbon dioxide emissions. Keep your water-heater thermostat no higher than 120° F and you can reduce carbon dioxide emissions by 550 pounds a year.

Put the Freeze on Inefficient Appliances

Get rid of old, energy-inefficient appliances and replace with newer, energy-efficient models. For example, a high-energy-efficient refrigerator will reduce carbon dioxide emissions by 450 pounds a year. For more information on energy-efficient appliances, visit the Energy Star Web site at www.energystar.gov. Look for the Energy Star label when shopping.

Reduce and Recycle

Reducing your garbage by 25% will reduce carbon dioxide emissions by 1,000 pounds a year. Recycle aluminum cans, glass bottles, plastic, and cardboard to reduce your home's carbon dioxide emissions by 850 pounds a year.

Don't Give Energy Away

If you caulk and weather-strip around doors and windows to plug up leaks, you can reduce carbon dioxide emissions by 1,000 pounds a year.

Take the Green Way

Leave your car at home two days a week (walk, bike, take public transportation) and you can reduce carbon dioxide emissions by 1,590 pounds per year.

Slow the Flow

If purchasing a new vehicle, consider finding a car that gets more miles to the gallon than your current vehicle, and match that vehicle to your needs. The potential carbon dioxide reduction for a car that gets 32 miles per gallon is 5,600 pounds a year.

Make the Right Move

If you spend hours on the road every day to get to work, you could save significant time and money by moving closer to work and reducing your commute. The carbon dioxide emissions you save are icing on the cake.

Be a Turn Off

Turn off your TV, video player, stereo, and computer when you aren't using them. Turn off your lights when you don't need them, and start saving within a minute or two.

Trim Your Load

When you do drive, keep your car tuned and its tires properly inflated. This helps you save on fuel costs while reducing carbon emissions. A tune-up can boost your miles per gallon anywhere from 4 to 40%; a new air filter can get you 10% more miles per gallon. For more savings, take your roof rack off your car when you aren't using it.

Other Important Tips

- ◆ Use programmable thermostats so you don't waste energy when you're at work or out of the house.
- ◆ Use lights that work off solar energy. They're quite common now and realistic in price.
- ◆ Change your heating and cooling filters every month. This not only saves electricity, but lengthens the life of the appliance.
- ◆ Plant trees. Set a goal of being CO² neutral, which means the amount of CO² that a family produces needs to be offset by planting trees that can transform it back into oxygen.
- ◆ Support the research and educational efforts of Polar Bears International and other conservation-minded organizations by making a donation or volunteering your time and talents. We each need to be an active steward of our Mother Earth.

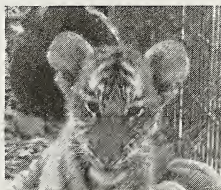


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“Champagne Training on a Beer Budget”

By

Traci Belting, Point Defiance Zoo and Aquarium, Tacoma, WA

This paper was originally presented at the

International Polar Bear Husbandry Conference February 5, 2004, San Diego

Traci Belting is now Curator of Mammals & Birds at the Seattle Aquarium

During this conference, many of our colleagues will be discussing the application of operant conditioning techniques and particularly the role that positive reinforcement plays in modern polar bear management in zoos and aquariums.

This paper will take a more reflective approach in order to highlight the evolution of the formal polar bear training program at the Point Defiance Zoo and Aquarium. It will focus on some of the behavioral challenges that we have faced and mention some of the strategies that we have found helpful.

While many of you have decades of experience with polar bears, I had not had the pleasure prior to working at Point Defiance. I had trained marine mammals and birds, but this part-marine/part-terrestrial carnivore was beyond the realm of my experience. I still remember my first day as we toured the polar bear holding area. As I walked past the fence, a bear sat calmly watching the procession. Just as I turned my head to watch the keeper in front of me, the bear reared up on his hind legs, thunderously hit the fence with his front paws, and remained erect, standing a full three feet taller than me. All the while he was emitting a loud “SSSSHHHHH” sound that reverberated straight through me. I took my cue, respectfully exited the area, and waited for my heart rate to return to normal. After more than seven years now working with polar bears, I can proudly say that their behavior has become more predictable and I no longer have to bring a change of underwear to work!

To be quite honest, there was a time in the not-so-distant past when the staff at Point Defiance believed that they didn’t have enough personnel or time to train polar bears. The general philosophy seemed to be that it was appropriate to put time and energy into training some animals, while others – because of their disposition – should not or could not be trained. Polar bears fell into the latter category. In hindsight, this thinking seems ridiculous because in general all animals behave for one of two reasons:

* To acquire desirable outcomes

OR

* To avoid undesirable outcomes

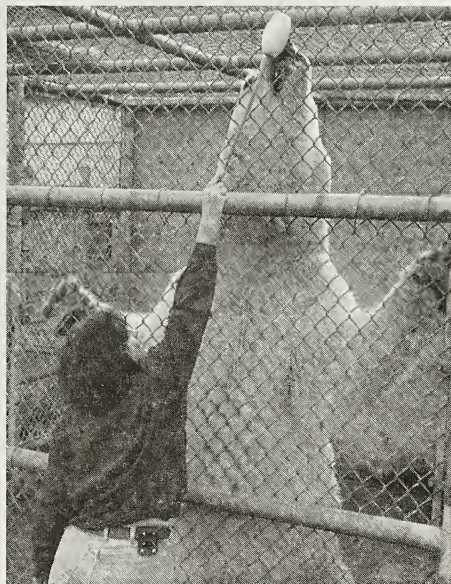
The polar bear is no exception.

Given that the bears were aware of every aspect of their environment, we were training them whether we wanted to admit it or not. As animal caretakers, we influence how and what our animals learn. There are times we make a conscious effort to train a particular behavior for husbandry, research, education, or entertainment purposes. But, more often, we influence an animal’s behavior inadvertently through our actions or our husbandry routines. In effect, we are always training and this fact needs to be kept at the forefront of strategic planning when it comes to behavioral issues.

Our formal bear-training program was initiated just over six year ago when the zoo’s keeper teams were restructured and the marine mammal training staff was integrated in with the existing polar bear keepers. At the time, our collection consisted of 3.2 bears. Two of the bears were older (a 30-year-old male and a 20-year-old female) while the other three bears were each less than two years of age. None had any previous training history. We decided to use the zoo elephants’ well-established protected-contact training program as a model. We initially thought that training the bears would be a long, arduous process because we had very little time to devote to it. Our staff was relatively small

and, because we had other animals to care for, we could only carry out one or two training sessions per day, each rarely exceeding 10 minutes. But the bears responded quickly. Within a matter of months, we succeeded in training all five bears in basic management behaviors including:

- Responding to a verbal “good” or visual point as a bridging stimulus
- Targeting
- Follows
- Sit. This behavior was especially important for positioning a bear on our scale.
- Down
- Front paw presentation
- Mouth inspections
- Gate Desensitization. The movement of a gate no longer cued an animal to shift; instead, they waited for a signal from their trainer. This provided us with much greater flexibility in moving bears to and from the main exhibit and throughout our holding facility.



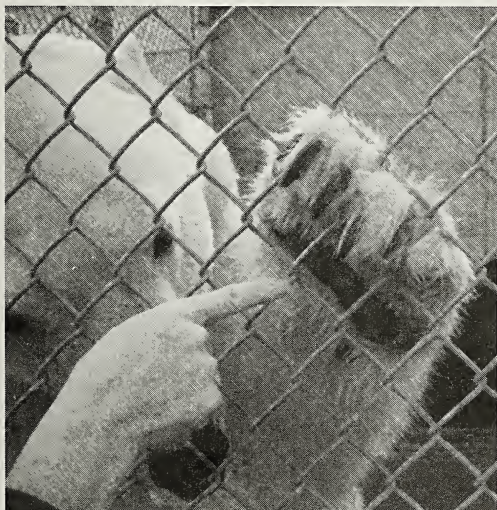
A target is used to position a bear as part of a visual body exam.

These behaviors are relatively basic, but they had a huge impact on animal management. Before formal training, shifting the bears from one area to another occurred slowly, unreliably and sometimes not at all. Now shifting occurs consistently and quickly. The bears also now offer cooperatively several behaviors that used to require chemical restraint.

Once upon a time we thought we didn't have enough staff or time to train. In reality, we didn't have enough staff or time NOT to train.

While training obviously benefits the staff with regard to time management and husbandry goals, the greatest benefit is to the bears. Fundamentally, operant conditioning relies on an animal's ability to choose. The behavioral choices that an animal makes will impact the consequences that follow.

Providing an animal with the opportunity to choose replicates to some extent the pathway for learning that occurs in the wild. One obvious difference is that a bear's incorrect choice in the wild could result in death, whereas in a controlled environment like a zoo or aquarium, a more likely consequence is simply the removal of positive reinforcement.



Bears can be trained to present various body parts for exam

The cornerstone of protected-contact training is the understanding that you can't make an animal do anything it doesn't want to do. Our job as trainers is to make the learning process so positive and so interesting that the bears are motivated to participate. As a training program grows, sometimes the goals can become so focused on specific behaviors that we lose sight of the bigger picture. We need to create a positive attitude toward learning. Remember that it is the behavior that is being reinforced or

punished, not the animal! Because we as trainers are the ones delivering the reinforcement, we have the power to shift the balance of learning towards success. Although it's normal for an animal to fail when learning a new behavior, it's up to us to make sure the victories far outweigh the failures.

In order to set a bear up to succeed in a training program, it is important to:

- Design a training plan for every behavior with as many steps as necessary to clearly communicate the goal.
- In any one training session, move one or two steps toward a desired response and stop. Sometimes, as trainers, we get too exuberant when we get a positive response and we want to move quickly to the next approximation. So often, however, this increases the likelihood of confusion and/or frustration and could potentially result in the inadvertent reinforcement of less-than-desirable criteria.
- Be consistent. Ideally, a single trainer would work on a particular behavior throughout the behavior acquisition phase and multiple trainers could then maintain the behavior. It's important to recognize that some animals can tolerate more trainers than others; when multiple trainers are being used, good communication among those trainers is critical.
- Take into consideration the animal's hunger level. We found it helpful to feed the bears prior to training sessions in order to take the edge off. We all know how much a bear's appetite can fluctuate seasonally. If a bear is too hungry, it can become so intent on obtaining food rewards that it loses focus on the training task and can become easily frustrated when food isn't delivered.
- Avoid the use of aversive stimuli. I am sure that you will all agree with me that except in extreme emergencies, we need to avoid the use of aversive stimuli. While negative reinforcement undeniably can be used to shape behavior, it does nothing to build trust between bear and trainer and certainly doesn't support a positive learning environment.
- Keep things interesting and varied. Once a training program is established, some factors that can be varied include:
 - o Location for performing behaviors
 - o Order of behaviors (When doing paw presents, for example, don't always ask for the right paw first, etc.)
 - o Number of training sessions per day
 - o Length of sessions
 - o Time of day sessions occur

Being unpredictable can include:

- o Shifting a bear onto exhibit and then right back off
- o Opening a shift door and then cueing the bear to follow you in the opposite direction
- o Starting a training session but, rather than asking for a behavior, feeding the bear instead for calm responses.

The possibilities are endless.

- Consider each bear's individual history so as to select the most effective and appropriate techniques to proceed with training.

For us, this point became quite evident when we received two adult male bears, 18-year-old Boris and 16-year-old Kenneth. Many of you followed the plight of the polar bears formerly with the Mexico-based Suarez Brothers Circus. On 5 November 2002 in Puerto Rico, the U.S. Department of Justice regionally confiscated Boris and Kenny along with four other bears. Boris and Kenny arrived two weeks later at Point Defiance. They had been living in sweltering heat and were suffering from fungal skin infections, parasites, nutritional deficiencies, and – in the case of Kenny – a severe stereotypic swaying behavior.

Two male bears were already living at Point Defiance when Boris and Kenny arrived. Suddenly we were faced with the challenge of managing a group of four adult male bears. The new arrivals had been previously trained using operant conditioning, only they were used to making choices to avoid punishment rather than acquire rewards.

During their initial quarantine, Boris and Kenny would flinch in avoidance and offer submissive postures in response to any quick movement from the staff. It took time to gain their trust. Eventually they began to accept food from us through the fence and building relationships began. We needed extra time to habituate the bears to the presence of a target pole, then to condition it as a positive stimulus, because the bears' initial response to the sight of the pole was avoidance.

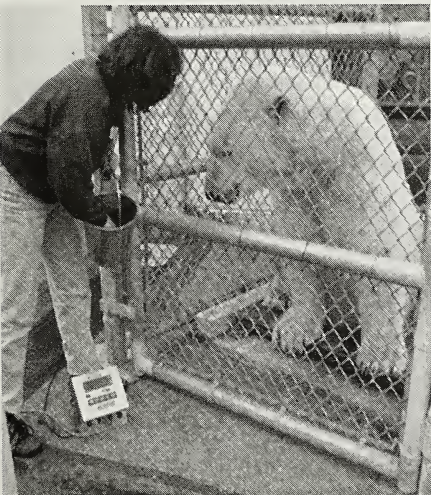


A mouth open behavior allows for daily dental checks.

I think that it is a testament to the power of positive reinforcement that within a matter of weeks we were able to overcome the bears' negative responses and lay the foundation for successful acclimation into our existing bear management program.

Once we had the bears tentatively following us, we attempted to get voluntary weights. While most of the surfaces in our holding areas are relatively level, our scale is slightly raised. The bears had identical reactions to stepping on the platform for the first time: each one immediately sat down and remained perfectly still. Despite our best efforts to encourage them along, they remained on the platform. We tried tempting them with food but they would only eat what they could reach without moving their feet from the platform. Apparently their previous experience with remaining still on a circus platform was stronger than their brief reinforcement history with us. We had to regress back to spending more time on basic follows in other parts of the holding area in order to shift the balance in our favor and overcome their predilection to stall on the platform.

A landmark day for Boris and Kenny occurred on 6 February 2003. They finally passed quarantine and were introduced onto the main exhibit. For the first time in decades, they were able to submerge themselves and swim in natural seawater. Initially we had planned to exhibit Boris and Kenny together, but their aggressive interactions intensified as their health improved. Although Boris was initially dominant over Kenny, this dominance hierarchy switched within a few days of their introduction onto the main exhibit. Kenny became so dominant over Boris that Boris appeared reluctant to move and remained relegated to the far corner of the exhibit. Despite trying various strategies – including varying the shift order, adjusting the time they spent together on exhibit, and reinforcing Kenny for allowing Boris to move – Boris remained submissively motionless as far away from Kenny as possible. We decided to separate the bears and rotate their time on exhibit. Although it took several days for Boris to trust that Kenny wasn't out there hiding somewhere, he is now an incredibly active and playful bear. This change in his demeanor has reinforced the



Weighing bears becomes simple when they are trained to voluntarily sit on the scale.

importance of our goal of providing all the bears in our care with the most positive environment possible.

As trainers, we all agree that we should focus on the positive and avoid circumstances that elicit undesirable results. It is inevitable, however, that animals will develop or offer behavior that we don't want. Animals will make mistakes on occasion. When this happens, it is essential that we not overreact and draw attention to the problem.

When a bear offers undesirable behavior, certain things should be considered:

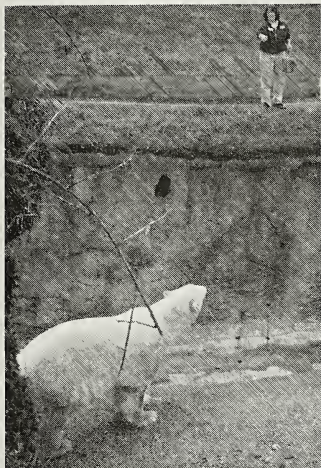
- Is the behavior being bridged properly? The bridge is designed to deliver positive feedback with pinpoint accuracy in order to let an animal know instantaneously that it is performing a behavior correctly. Behavioral breakdown often stems from confusion associated with inconsistent bridging.
- Are all staff consistently using the correct SD (signal)? As trainers, we need to watch each other and discuss any variations in SD's and make sure that we are being as clear as possible.
- Are the behavioral criteria clear? If one trainer is accepting one set of criteria and another is expecting something else, an animal easily can become confused or frustrated.
- Has stimulus control broken down due to predictability? This can be especially challenging in the case of animals that are shifted on and off exhibit at set times.
- Do overriding social situations exist? Boris and Kenny's dominance shift exemplifies how significantly social pressure can impact behavior.
- Is there a physical problem causing the animal to fail?
- Are there environmental influences or changes? Because these bears have such keen senses, any major change in their environment can have an impact on behavior, both positive and negative.

Observation is one of our best defenses when it comes to dealing with inappropriate behavior. If the frequency of an undesirable behavior is increasing, then somehow, in some way, it is being reinforced. Through careful observation, we can determine what is reinforcing the behavior and, if possible, identify any precursors so as to avoid the problem in future. Once an animal learns a behavior, it is very difficult to unlearn it. It is especially important to realize that an animal's first learning experience in a particular context is usually the strongest. Let's say, for example, that a bear tentatively shifts into a new area for the first time, only to have the gate slam shut behind him and trap him. This negative experience will be deeply imbedded. Even if you go back later and spend lots of time using positive reinforcement to desensitize the bear to gate movements, the initial negative response will always be lurking in the bear's behavioral repertoire and will reappear continually when you least expect it. This is why it is so important to plan ahead so that an animal's first experience in any given situation is a positive one.

Despite our best efforts and intentions, animals still will learn undesirable behaviors. Therefore it is important to know some effective techniques for reducing the frequency of these behaviors. Operant extinction is a process by which the reinforcement of a previously learned behavior is discontinued. If a behavior no longer produces any reinforcing consequences, it will fade over time. For example, if a bear bangs on a door and the door opens, the behavior is reinforced. But if the bear bangs on the door and the door no longer opens (i.e. door-banging no longer produces the desired reward), the frequency of the behavior will decrease. A behavior will often get worse before it gets better, but you can bet that if the behavior is never reinforced, it will disappear eventually.

Studies have shown that it is much easier to extinguish a behavior if an animal has an alternative way to get reinforced. A technique often referred to as Differential Reinforcement of Incompatible

behavior, or DRI, allows for this. With DRI, a response that is incompatible or competitive with the undesirable response is reinforced. Let's say, for example, that a bear is shifting through a gate before being cued. Before opening the gate, ask the bear to lie down. A bear cannot lie down quietly and rush out of a gate at the same time. These behaviors are incompatible.



Shifting a bear onto exhibit happens quickly when they are trained.

Solving behavioral problems is an ongoing process. As trainers, we must constantly consider a variety of training strategies that might prove helpful. This is especially true at a facility that would be crazy enough to manage a collection of four adult male polar bears. Given that conservation is one of the primary missions of the Point Defiance Zoo and Aquarium, we felt privileged to participate in the rescue effort of the Suarez Brothers bears and to provide sanctuary for Boris and Kenny. As animal care staff, we are incredibly proud of the progress they have made in a relatively short amount of time. Regular visitors to the zoo can no longer distinguish between Boris and Kenny and our resident bears Blizzard and Glacier. This is testament to how much Boris and Kenny's behavioral and physical health have improved.

We currently exhibit only two bears at a time, but it remains possible that through careful behavioral evaluation and the application of positive reinforcement we can increase the number of combinations of bears that can be exhibited together. We have begun to introduce all of the bears informally through a fence in our holding area. With careful planning, we hope to expand those small windows of social interaction that occur naturally in the wild and provide our bears with a diverse and enriching experience. With the information gathered at this conference and the opportunity to learn from each other, we will continue to provide our bears with champion training.

Acknowledgements: I would like to thank our animal care staff: Lisa Triggs, Margaret Gaspari, Mike Messersmith, Rebecca Stocker and Jean Joseph. Jean deserves additional accolades for her photography assistance. I would like to thank our Administration for their ongoing support of our bear training efforts and of course, a huge thank you to Blizzard, Glacier, Boris and Kenny.

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(All photos provided by the author)

Training allows you to place natural behaviors on cue.

The Polar Population Project

Given the sense of urgency related to Arctic climate change and how it affects polar bears, PBI has launched a major new initiative called the Polar Population Project, or Tri-P, based on the three “Ps” in its name. The broad-based initiative was developed after consulting with the scientists of PBI’s Advisory Council. These experts worked as a team to define the most critical research needs in order to ensure the long-term survival of the bears.

“Everyone understood the importance of working together,” says PBI’s President, Robert Buchanan. “We had some ground-breaking discussions and came away with a solid plan.”

A Warming Arctic

Dr. Steven C. Amstrup, a polar bear scientist from Alaska who serves on PBI’s Advisory Council, announced the launch of the Tri-P at a PBI press conference held at the San Diego Zoo. He began by summarizing the mounting evidence that the Arctic is undergoing a rapid warming trend:

- Arctic perennial sea ice has been declining by more than 9% per decade. As a result, the summer ice coverage in the early 2000s was 1.5 million kilometers smaller than it was in the early 1980s.
- Over the same time frame, sea ice thickness declined by more than a meter. “We not only have less ice area, but much less volume as well,” he said.
- The latest predictions, from the National Center for Atmospheric Research (NCAR), suggest that the polar basin could be largely ice-free in 40 years, raising concerns about the long-term survival of polar bears.

Amstrup noted that changes in ice coverage directly affect polar bear populations, as the bears use ice as a platform for catching seals. He pointed out that the two populations that scientists know the most about—Western Hudson Bay and the Southern Beaufort Sea—are showing signs of stress, apparently in response to shrinking sea ice coverage.

“Declining survival rates, associated with earlier sea ice break-up in the spring, has been confirmed in Western Hudson Bay,” he said. “That population has dropped from over 1,100 bears in 1987 to 935 in 2004.”

The Southern Beaufort Sea population, which spans northern Alaska and western Canada, is also showing signs of stress, the scientists reported. “We have observed declining physical stature in cubs and adult males, and declining survival and recruitment rates,” he said.

Action Needed

Despite this sobering news, Amstrup emphasized that hope remains. “Polar bears have survived at least one warm period in the past,” he said, “and we know that natural variation lends some uncertainty to predications. We also know that, with resolve, we can manage the extent to which humans are contributing to predicted climate change.

“Therefore,” he told the audience, “we are gathered here to discuss priority initiatives for the polar bear’s future.”

Amstrup explained that in order to help the bears, it is critical to have accurate information on what is happening. At present, much of what we know about polar bears comes from long term data collected on two of the 18 polar bear populations (Western Hudson Bay and the Southern Beaufort

Sea). Knowledge of the other 16 populations is mixed, and polar bear specialists agree that information on many of them is urgently needed so that scientists can understand exactly what is happening to the bears worldwide. At the same time, it's imperative that the long-term studies on the Western Hudson Bay and Southern Beaufort Sea bears continue. [Editor's note: Some scientists cite a total of 19 populations instead of 18. The 19th region is the central polar basin. Although it is possible there could be a population living there that never associates with surrounding land masses, there are no data to substantiate that hypothesis.]

New Research Methods

Robert Buchanan, PBI's president, said that the prime reason that only two of the 18 polar bear populations have been extensively studied is that current census methods are difficult and expensive. The good news is that aerial surveys, which employ what are called distance sampling methods, show great promise. The first step in the Tri-P initiative, then, is for Dr. Nick Lunn and his colleagues to test the method on the Western Hudson Bay bears next fall. Because we know so much about the Western Hudson Bay population, applying these methods there will allow them to be tested and calibrated. Once the method has been calibrated, aerial surveys will provide scientists with a fast and relatively inexpensive way of determining the status of at least five other polar bear populations, all of which spend their summers on land.



Dr. Steven C. Amstrup announces the Tri-P Initiative at San Diego press conference. *Photo: © R&C Buchanan)*

The remaining populations, which summer on the sea ice, pose a different problem. Therefore, an equally important component of the Tri-P Initiative is to develop methods of surveying these bears. "We need to develop tactical research and monitoring methods that can help us understand the status of regions like northern Canada and the Chukchi Sea of Alaska, where polar bears usually don't spend much time on land," Amstrup said. These methods will probably vary slightly from population to population due to differing conditions.

The third and equally important final component of the Tri-P, Amstrup noted, is to continue the long-term studies in Western Hudson Bay and the Southern Beaufort Sea. Only by continuing those long-term data sets will we have the information necessary to document continuing responses to ongoing climate and sea ice changes.

Hope for the Bears

Simply put, the Tri-P is an umbrella project that will allow PBI to focus its research efforts on the most urgently needed data. "Understanding exactly what is happening with polar bears and the sea ice is the first step toward ensuring that the bears are around for future generations," Buchanan said. "PBI's approach has always been, 'A problem well-defined is a problem half solved.'"

During earlier warming trends, said Buchanan, polar bears probably survived in small pockets. "It's thought that small groups held on in micro-climates with thicker ice," he explained.

"Once we understand the overall movement patterns of the bears and where they're the healthiest," he added, "we'll be able to create sanctuaries for them. But we need solid baseline data in order to do so."

So far, major funding for the Tri-P has come from the Burns Foundation, Lowepro, the Manitoba Provincial Government, Power Corp. of Canada, and the San Diego Zoo. Winnipeg's Partners in the Park provided vitally important logistical coordination. Donations to PBI will also help support the project as well.

Raising the Standards in Zoos

PBI Advisory Council member Bill Watkins of Winnipeg, Manitoba, has been working with North American zoos to ensure that new polar bear exhibits meet the high standards for care set by the province, which is home to Churchill and its polar bears. "It's been quite rewarding to see zoos move beyond the concrete, pool, and moat exhibits of the 1960s," he says. "Zoos have not only embraced the Manitoba Standards, but they've been contacting me to review their plans and meet with their design teams."



Biologist Bill Watkins of Manitoba has been advising zoos on exhibit design standards for polar bears that were set by the Province of Manitoba. *Photo © R & C Buchanan*

Watkins, a wildlife biologist with Manitoba Conservation and a volunteer instructor at PBI's Polar Bear Leadership Camp, has found that most zoo personnel have a passionate concern for the animals in their care. They want to construct facilities that ensure the well-being of their polar bears and provide enrichment.

So far Watkins has visited three U.S. zoos to offer advice on new polar bear exhibits: the Henry Vilas Zoo in Madison, WI; the Louisville Zoo in Kentucky; and the Columbus Zoo in Ohio. While there, he also met with zoo educators on interpretative programs that focus on polar bears and the Arctic, including content for exhibit signs.

"I gave presentations on conservation issues, bear biology, and Churchill's 'Polar Bear Alert Program,'" he says. "It was an added benefit for the zoos, I think, that I was able to cover that."

Watkins says that he was really impressed with the new designs. "What I find intriguing is the way the new exhibits tell a story," he says. "For example, the Henry Vilas Zoo will have a viewing platform for people to stand on that looks like the deck of an old sailing ship. Visitors will have the feeling that they're sailing through the Arctic like an early explorer. On one side they'll see polar bears and on the other side they'll see seals."

PBI has long promoted a healthy exchange of ideas between those who work with wild polar bears and those who work with bears in zoos and aquariums. Five years ago, PBI organized the first networking event to feature both groups by hosting a conference at the Tundra Buggy Lodge® near Churchill; that was followed up two years later with a larger, international conference in San Diego that brought together both scientists and zoo personnel. The mutually beneficial networking and collaborative research continues to this day.

Polar Bear Standardized Guidelines

This 57-page document covers all aspects of caring for polar bears in zoos. Topics range from exhibit design to health, nutrition, reproduction, and behavioral enrichment. AZA's Bear TAG created the manual in association with the AZA Animal Welfare Committee. PBI helped with funding its production.

You can download this file at:

<http://www.polarbearsinternational.org/polar-bear-standardized-guidelines/>

Zoos Housing Polar Bears Worldwide

(last updated February 27, 2007)

Source: *Polar Bears International Website* (<http://www.polarbearsinternational.org/>)

Aalborg Zoo, Denmark	1.2
Alaska Zoo, Alaska, USA	1.1
Aquarium De Quebec, Quebec, Canada	1.1
Artis Zoo, The Netherlands	0.2
Assiniboine Park Zoo, Manitoba, Canada	0.1
Bolscheretschenskii Zoopark, Russia	1.1
Bronx Zoo, New York, USA	1.0
Brookfield Zoo, Illinois, USA	1.1
Budapest Zool & Botanical Garden, Hungary	1.1
Buffalo Zoological Gardens, New York, USA	1.2
Calgary Zoo, Alberta, Canada	0.2
Cantabrica De Silos S A, Spain	1.1
Central Park Wildlife Center, New York, USA	1.1
Cincinnati Zoo & Botanical Garden, Ohio, USA	1.2
Cleveland Metroparks Zoo, Ohio, USA	0.2
Cochrane Polar Bear Habitat, Ontario, Canada	1.2
Copenhagen Zoo, Denmark	1.1
Denver Zoological Gardens, Colorado, USA	2.2
Detroit Zoological Park, Michigan, USA	2.2
Ecotarium, Massachusetts, USA	0.1
Edinburgh Zoo-Scottish National Zoo, Scotland	0.1
Ekaterinburgskii Zoopark, Russia	1.1
Emcc/Tallinn Zoo, Estonia	1.1.1
Erie Zoo, Pennsylvania, USA	2.0
Flamingo Land, Yorkshire, England	0.1
Giardino Zoologico Di Pistoia, Italy	1.1
Henry Vilas Zoo, Wisconsin, USA	1.1
Indianapolis Zoo, Indiana, USA	1.1.1
Jardin Zoologique de Quebec, Quebec, Canada	0.1
Kaliningradskii Zoopark, Russia	1.1
Karlsruhe Zoologischer Garten, Germany	3.3
Kazanskii Zoobotanicheskii Sad, Russia	1.2
Khar Kovskii Zoologicheskii Park, Ukraine	2.0
Kolmardens Djurpark, Sweden	1.2
La Palmyre Zoo, France	1.2
Lake Superior Zoological Gardens, Minnesota, USA	1.1
Leningrad Zoo-St Petersburg, Russia	4.1
Lietuvos Zoologijos Sodas, Lithuania	1.1
Lincoln Park Zoo, Illinois, USA	1.1
Louisville Zoological Garden, Kentucky, USA	1.0
Memphis Zoo, Tennessee, USA	1.2
Miejski Ogród Zoologiczny Warszawa, Poland	1.1
Miejski Ogród Zoologiczny, Poland	0.1
Milwaukee County Zoological Garden, Wisconsin, USA	1.1
Monde Sauvage Safari Sprl, Belgium	2.1
Moscow Zoological Park, Russia	2.2.2
Nikolaev Zoo, Ukraine	1.1
North Carolina Zoological Park, North Carolina, USA	2.0
Novosibirskii Zoopark, Russia	1.0
Omaha's Henry Doorly Zoo, Nebraska, USA	0.2

Oregon Zoo, Oregon, USA	1.2	
Ouwehand Zoo, T Coulange The Netherlands	2.5	
Parc Zoologique Du Bois De Coulange, France	0.2	
Parc Zoologique Du Tertre Rouge, France	1.1	
Parc Zoologique Et Botan, France	2.2.2	
Permskii Zoologicheskii Sad, Russia	1.1	
Philadelphia Zoological Garden, Pennsylvania, USA	0.2	
Pittsburg Zoo, Pennsylvania, USA	2.0	
Point Defiance Zoo ... Aquarium, Washington, USA	4.0	
Prague Zoo, Czech Republic	1.1.1	
Ranua Zoo, Finland	1.0	
Reid Park Zoo, Arizona, USA	1.1	
Riga Zoo, Latvia	1.1	
Rio Grande Zoo, New Mexico, USA	2.2	
Roger Williams Park Zoo, Rhode Island, USA		<i>Exhibit under renovation; to open 2010</i>
Rostock Zoologischer Garten, Germany	1.4	
Rostov-on-Don Zoo, Russia	1.0	
Ruhr Zoo Betriebsges M B H, Germany	0.1	
Safari De Peaugres, France	1.2	
Saint Louis Zoological Park, Missouri, USA	0.1	
San Diego Zoo, California, USA	2.3	
San Francisco Zoological Gardens, California, USA	0.3	
SeaWorld Gold Coast-Queensland, Australia	2.1	
SeaWorld Orlando, Florida, USA	2.2	
SeaWorld San Diego, California, USA	1.2	
Seneca Park Zoo, New York, USA	1.1	
Severskii Zoopark, Russia	1.0	
Skandinavisk Dyrepark, Denmark	2.2	
Slaski Ogrpd Zool Katoqice-Charzow, Poland	0.1	
Sosto Zoo, Hungary	1.1	
St. Felicien Zoo, Quebec, Canada	1.2	
St. Paul's Como Zoo, Minnesota, USA	2.0	
The Maryland Zoo in Baltimore, Maryland, USA	1.1	
Tiergarten Neumuenster, Germany	1.1	
Tiergarten Schoenbrunn, Austria	1.1	
Tiergarten Straubing, Germany	1.0	
Tierpark Carl Hagenbeck GmbH, Germany	1.2	
Tierpark Hellabrunn, Germany	1.2	
Toledo Zoo, Ohio, USA	1.2	
Toronto Zoo, Ontario, Canada	2.2	
Tp Berlin-Friedrichsfelde GmbH, Germany	1.1	
Tulsa Zoo and Living Museum, Oklahoma, USA	1.0	
Utah's Hogle Zoo, Utah, USA	1.0	
Wilhelma, Germany	1.2	
Wuppertal Zoological Garten, Germany	1.1	
Zoo Am Meer, Germany	1.1	
Zoo Osnabrueck, Germany	1.1	
Zool Zahr Ostrava-Stromovka, Czech Republic	0.1	
Zoologicka Zahrada Mesta Brno, Czech Republic	1.1	
Zoologischer Garten Berlin, Germany	1.3	
Zoologischer Garten Hannover, Germany	0.1	
Zoologischer Garten Leipzig, Germany	0.2	
Zoosafari, Italy	1.2	
Zoo Palic, Serbia	1.1.1	

Operant Conditioning with Polar Bears - Another Form of Enrichment

By

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After three years of extensive research, planning and development, Sea World Australia has arguably the most sophisticated and innovative Polar Bear exhibit in the world (home to six-year-old male "Ping Ping", 18-year-old female "Kanook" and our new arrivals "Liya" and "Lyutyik", one-year-old cubs).

Polar Bear Shores (PBS) simulates a naturalistic summer arctic exhibit, equipped with environmental enhancements to create an unpredictable environment. It also includes five air-conditioned dens (four with chilled saltwater pools), plus a specially designed maternity den and a large off-display exercise yard complete with pool, climbing structures and foraging pit.

This AUD\$7 million complex is state of the art, however there is still more to successfully managing polar bears in captivity. Polar bears are notorious for displaying stereotypic behaviors, so an extensive behavioral enrichment plan was developed to compliment the environmental enhancement system. Together they form the Polar Bear Shores Enrichment Program.



Main Exhibit Overview

POLAR BEAR ENRICHMENT PROGRAM

Environmental and behavioral enrichment are often intertwined to form a program that provides animals in captivity with a more challenging and stimulating environment to increase the range and diversity of natural behavioral patterns.

The Polar Bear Enrichment Program comprises six categories:

1. EXHIBIT DESIGN

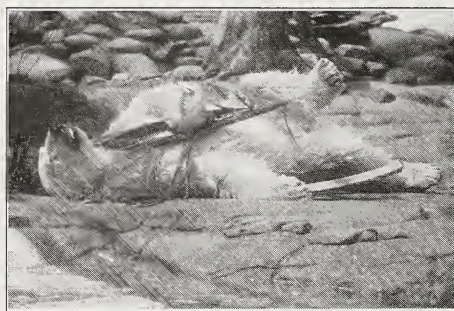
Simulates a natural summer arctic environment using:

- natural furniture (logs, rocks, creek bed, garden beds with natural foliage, digging pits)
- rock formations varying in height
- large salt water pool and three fresh water ponds with waterfalls
- weather controls using rain, wind generators and fogging system



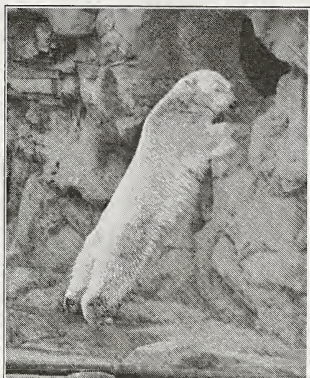
2. NOVEL OBJECTS

- Natural items (bamboo, movable logs, browse, tree stumps)
- Non-natural items (assortment of toys, ropes, containers, marine equipment such as boat buffers, etc)



3. SENSORY STIMULATION

- Olfactory – herbs, spices, essential oils, perfumes
- Tactile – browse, flowers, different substrates
- Taste – food items, spreads, syrups, and frozen food items
- Visual – live fish, natural formations, barriers and elevations



4. FEEDING STRATEGIES/FORAGING

- Hidden, scattered food and random feeding methods
- Iceblocks (fishicles, etc)

5. SOCIAL GROUPINGS

- Able to display bears together in naturalistic habitat with natural visual barriers (garden beds with trees, rock formations and large logs, etc).
- Rotating bears on exhibit and in back of house areas, allowing for solitude or choice of being in close proximity



6. OPERANT CONDITIONING

Operant conditioning (or behavioral training) using positive reinforcement techniques for husbandry/preventative medicine purposes.

It is this last form of enrichment that this paper will focus on; the “nuts and bolts” of our operant conditioning program.

OPERANT CONDITIONING

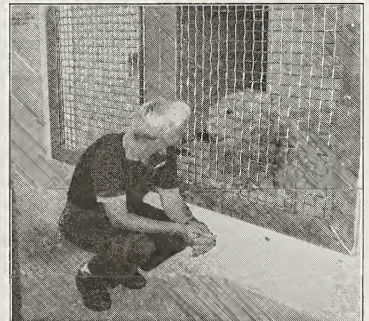
“The primary goals of an enrichment program are to provide a stimulating environment that allows animals to make choices, giving them some level of control over their environment” (Steve Martin, Natural Encounters) and to encourage a natural range of behaviors similar to the animal’s wild counterparts.

Training is teaching; being trained is learning. It is a problem-solving process that can easily be as challenging and rewarding as the most complex enrichment device (Tim Desmond ... Gaile Laule, 1998).

Operant Conditioning, using positive reinforcement, has proved to be a valuable technique as an animal care and management tool, resulting in benefits not only for the animals, but also for the caretakers, veterinarians and others concerned with the welfare of captive animals (Active Environments, 1993).

This type of training/conditioning relies on the voluntary co-operation of the animal to succeed. It can also assist with routine husbandry needs (including crate/den training), identify and address potential medical concerns before they develop, minimize stress related behavioral problems (such as stereotypic behaviors), as well as offer mental stimulation, a form of behavioral enrichment.

At Polar Bear Shores, we chose to incorporate operant conditioning with our four bears. Positive reinforcement training through “protected contact” was the preferred training method. Protected contact is made possible through 40mm square stainless steel mesh windows and doors of the five dens allowing full visual of the bears and presentation of different areas of the body.



Kerrie & Lyutyik

BUT WHAT TO TRAIN FIRST?

When developing our training program we looked at some key points which would assist with identifying what behaviors would be beneficial for our polar bears, keepers and veterinarian:

1. What are the most common health/physical problems with captive polar bears?
2. What are the management issues with regards to housing polar bears?
3. What preventative medicine techniques could we safely incorporate into the program?
4. Are there any individual behavioral problems or concerns with any of the animals?
5. Are there any health/physical concerns with the bears currently that need to be addressed?

After prioritising the behavioral, husbandry, medicinal and daily management issues, we began to implement regular training sessions.

TRAINING SESSION - GOALS

BRIDGE ASSOCIATION

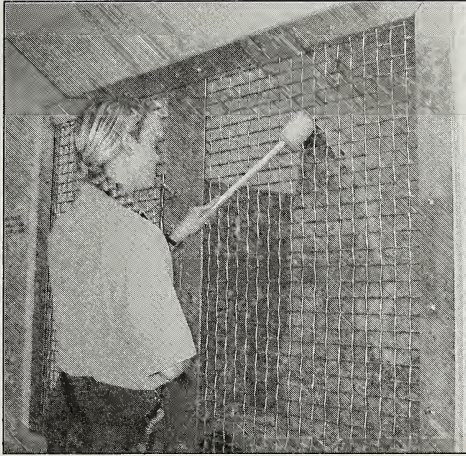
Because we were looking at using positive reinforcement training, our first goal was to establish “bridge” association. The bridge (also known as a conditioned reinforcer) is a training tool that bridges the time between a (correct) specific response and the reward given (in our case food reinforcement). When coupled with a requested behavior, or cue, the bridge tells the animal “yes that is correct!” (terminal bridge). In some instances, trainers use the bridge during a behavior “yes that is correct, keep going” (intermediate bridge). Here at Polar Bear Shores we only use the former of the two methods.



Kerrie teaching Kanook the bridge using dog whistle. A dog whistle is used as the bridge and the bears quickly learned the sound of the whistle is associated with food.

TARGETS

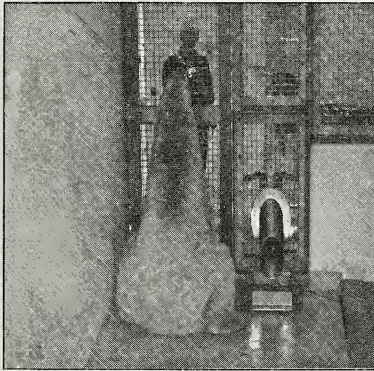
Next we introduced a target. This is either a hand (closed fist, left or right) or a target stick using 20mm PVC piping with a float on the end. The purpose of the target is to have the bears touch the target (hand or stick) with their nose and follow the target to wherever it moves. This is a useful tool when shaping other behaviors such as chest and shoulder/leg presentation (changing the topography of the animal). By using the target we can move and position the bears as needed. It can also be used to “station” the bears while doors or slides are closed and opened, as well as positioning on scales to obtain regular weights.



Sharon with Liya using a target stick

BASIC BEHAVIORS / CUES

After the bears were responding 100% to the bridge and confident with the target, we progressed to simple body positions which would later be used in preventative medicine desensitisation. These cues include:



- Sit – relax, similar position to that of a dog (see picture)
- Up – rise up on two legs (still in sit position or full stand)
- Down – come down from raised position
- Lie down – abdomen to floor, facing forward

A recall (metal on metal sound) was also introduced to call bears off-exhibit or into a particular den. The recall is normally coupled with the bear's name and associated with something positive (i.e. enrichment, diet, fresh bedding/browse, etc).

PREVENTATIVE MEDICINE

We began developing other behaviors for husbandry/preventative medicine purposes:

1. Open - Mouth/Teeth Inspection – this was achieved by touching outer lips with the thumb and forefinger, gradually approximating the behavior from slightly curling the lips to a full mouth open showing teeth and holding duration until bridged and rewarded.

Sharon shaping "Open" with Lyutyik



It was through shaping this behavior that we discovered our adult male bear, Ping Ping, had a discolored lower left canine. After having this inspected by a specialized dental veterinarian, it was confirmed the tooth was dead and needed root canal surgery. Had we not discovered this bad tooth, an infection was likely to have formed and extended along his jaw line resulting in a serious medical problem. This was avoided due to this training program and a successful root canal under general anesthetic was performed.



Teeth presentation with Ping Ping

To date Ping Ping reliably offers a mouth/teeth inspection with tongue depressor to the outer lips for better visual of canines and back teeth. We will soon begin developing this behavior further by brushing his upper incisors with toothpaste due to his gum receding in this area (we may need a supply of toothbrushes to shape this one!)

2. Paw Presentation and Treatment – polar bears have a tendency to incur problems with foreign objects becoming embedded in-between the toes and fur of their feet, in addition to possible cuts and abrasions to their pads. We initially focused on the underside of the bears paws (pads) and through gradual desensitisation have been able to add various medical aids to this presentation:

- Q-tip®/cotton swab (touch and rubbing pads)
- paint brushes, various sizes (to apply topical treatment)
- Betadine® spray to pads



Paw presentation with desensitisation to brush



Ping Ping offering both front paws

We have recently started to extend this paw presentation and treatment by shaping a front/top paw presentation with Ping Ping. Again, desensitisation to Q-tip®/cotton swabs and paint brushes is being included in this behavior (incorporating acceptance to forceps in the near future). The cue is the same for both sides of paw (cue being “paw”) using different positions to avoid confusion. Front paw presentation is given in a lie down position whereas pads (back/underside of paws, forefeet only) are given in sit/stand position.

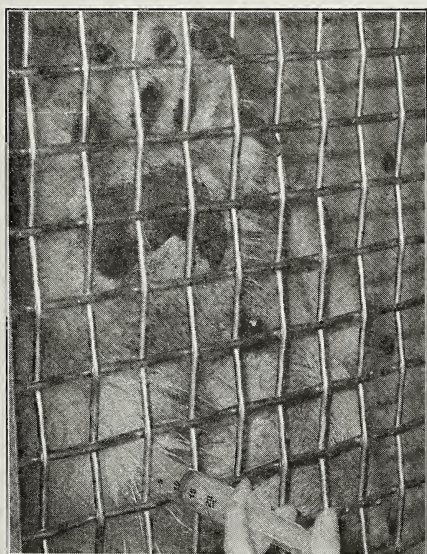
Below are more preventative medicine behaviors we are in the process of developing/shaping:

3. Abdomen/Chest ... Genital Presentation -

by using the target and ‘up’ cue, an abdomen/chest presentation is possible. The higher the target, the closer the bear comes to the window/door. Ultimately, the goal is to have the bear press against (or close to) the mesh for touching of different areas of abdomen/chest and genital area.



Target stick used to help with chest presentation

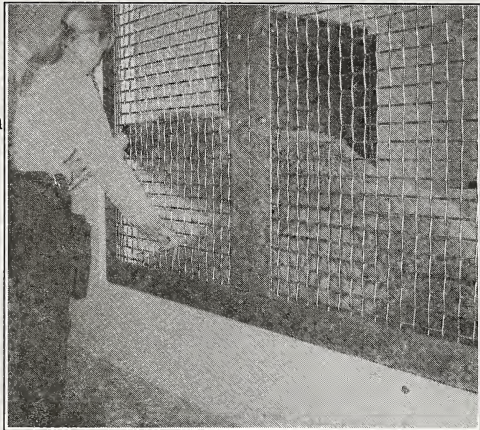


4. Foreleg (underside) Presentation– using “touch” as the cue with a long Q-tip®/cotton swab. Desensitising Ping Ping to touching both of his front legs while in ‘up’ position as this area is often pressed against the door or window. We have progressed to asking for longer duration and desensitization to a syringe and needle for a possible injection site.

Beginning stage of desensitisation to syringe

5. **Shoulder/Front Upper Leg Presentation** – using target to obtain a side profile positioning with the bears. Utilizing a ledge inside the den which encourages the bear to lift front leg up and rest it on the ledge. This offers an ideal opportunity to incorporate desensitization to a needle and syringe for another possible injection site and possible blood draw (a behavior that has not been achieved with polar bears to date).

Using target and second hand to encourage leg presentation

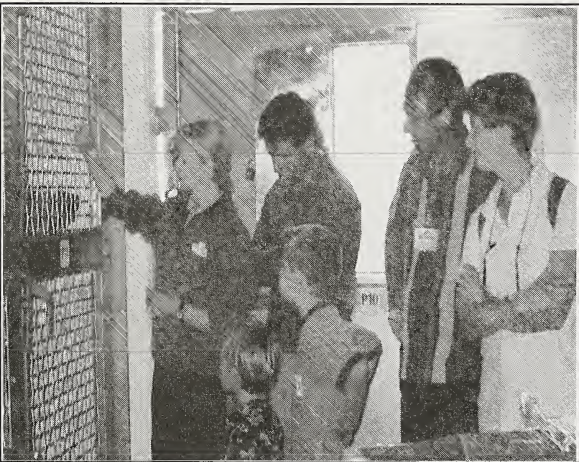


CHALLENGES CAN BE OVERCOME

When developing a new program (of any kind) there are going to be challenges and “teething” problems. We have found each bear had a unique challenge with regards to training and we adapted to these individual needs and overcame these challenges over the course of implementing this program. Of course, new concerns arise from time to time, and we have become flexible in our approach with our main priority being the well-being of the bears.

PING PING

Ping Ping is young, enthusiastic and a fast learner, however he is not a confident bear. Noises, distractions, and changes in routine can see him regress considerably with training. He occasionally shows signs of insecurity and fear in the presence of people, so developing a strong, positive rapport and trust was the priority with Ping before tackling any behaviors. Frequent hand feeding of his diet was incorporated into our daily routine that saw tremendous improvement in his confidence and overall acceptance of new things and people.



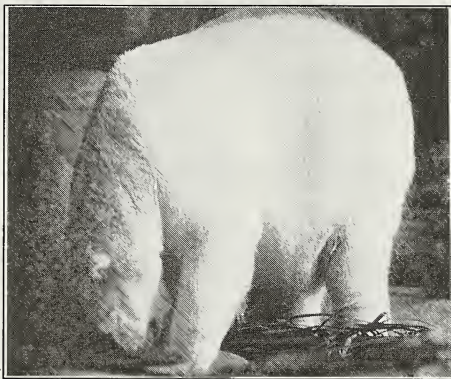
Training session for visiting vet

Training sessions soon became very reinforcing to him due to the positive attention and rewards he received. ‘Behind the Scene’ tours were randomly incorporated into the sessions and general visitors also became positive to Ping Ping. We are mindful of loud noises and situations that may set him back in training and with our relationship with him and endeavor to “set him up to succeed” in all sessions and use all dens and off-display areas for training to avoid associations with a single location.

KANOOK

Kanook is 18 years old and has lived in two different facilities before joining us here at Polar Bear Shores. Kanook has seen it all. Over the years, she had developed certain behavioral patterns including a strong stereotypic pacing habit (up to six hours a day). We were immediately faced with a challenge as curbing this behavioral problem was the highest priority to the staff.

We soon discovered that giving Kanook a sense of control over her environment was all that was needed to reduce this pacing habit. To do this we offered Kanook options as to where she could be (i.e. exhibit, air-conditioned dens, outdoor off-exhibit area, etc) giving her the opportunity to choose. When we had only two bears (Kanook and Ping Ping) we opened up the entire complex (exhibit and back of house areas) between 1100hrs and 1300hrs and the bears were free to explore, rest and play in any of these areas. This increased flexibility eliminated Kanook's stereotypic behavior.



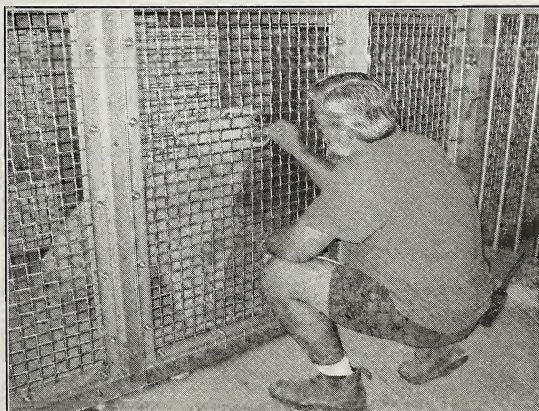
Kanook busy with an iceblock toy

Kanook is very fond of her food enrichment and spends considerable time on exhibit foraging for her food. This is beneficial from a behavioral and educational standpoint, however we found that training was not as positive as her enrichment on exhibit and she would not reliably participate in training sessions. By changing the session time to early morning, using her main diet, she became focused with increased interest and effort. She would still receive her enrichment on exhibit during the day; we simply offered a better alternative to suit Kanook and staff.

LIYA & LYUTYIK

Liya and Lyutyik came to PBS November 2001. Both cubs had to adjust to a major environmental change as well as being separated from their mother for the first time. It was for these reasons that we initially focused on providing a comfortable, safe and stimulating environment for the cubs. We also ensured the staff were continually reinforcing to the cubs and concentrated on building a positive relationship for the first month. Hand feeding and (protected) interactions were included in this development leading onto basic training sessions.

The cubs are only 12 months old so we keep the sessions short and reinforcing to maintain their interest, attention span and to avoid creating frustration.

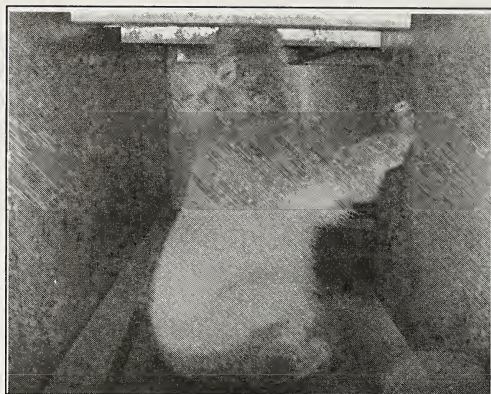


Des with Liya

Both bears have different personalities and we adapt the training sessions accordingly. For instance, Liya is high energy and very quick (sometimes erratic). Rewarding her for calm behavior is our main focus, developing behaviors second.

Whereas Lyutyik is slower to learn and he is easily distracted so keeping approximations small and rewarding each step is the priority. The cubs have not been separated (with the exception of transportation to Sea World) so we must also include gradual separation into the training sessions.

Lyutyik learning target on weigh scales



Both cubs have a tendency to be competitive so we must ensure we finish the sessions simultaneously to avoid aggression. By knowing what we want to achieve and communicating before the training sessions we avoid confusion and are making good progression with both cubs.

In addition to these individual challenges, we needed to be flexible with session times and adapt to various routines and requirements, such as:

- bears being on display for public viewing
- bear sleeping patterns are not disturbed
- main diet (daily food intake) is maintained according to each bears' needs
- bears are available for special public relations ... media events

After some trial and error, we had "adapted and overcome" the obstacles presented to us and incorporated a regular training regime for all bears which suits the animals and all parties involved with Polar Bear Shores management.

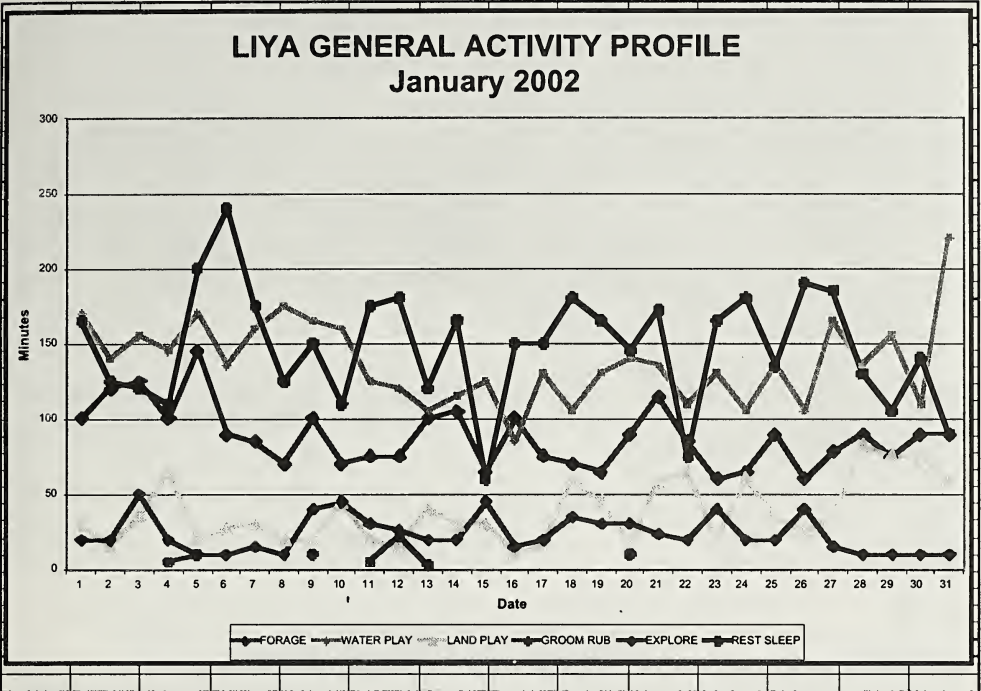
BEHAVIORAL PROFILES

In addition to the innovative approach adopted by PBS to manage the animals, we developed behavioral profiles that reflect the bears general activity and behavioural patterns. Daily husbandry logs are used to record the bears' behavior at different times throughout the day, whether on exhibit or off display. We looked at general bear behaviors (including stereotypies) to gather appropriate information. The information recorded includes:

- **Behavior** – forage, groom, swim, play, rest, nesting, investigating, walking, other
- **Interaction** – land or water, play, mating, soliciting, mouthing, vocalizing, aggression, other
- **Repetitive Motion** – pacing, set walking pattern, rock/sway, other

This data (and time engaged in each behavior) is collected daily and recorded on a monthly profile sheet with an accompanying graph to illustrate findings. These monthly profiles clearly reflect what types of activity the bears engage in, for what duration, if there are any behavioral changes and what possibly triggered these changes. This information has proven extremely valuable when monitoring individual bear behavior and when attempting to curb any aberrant/abnormal activity. We can also use these profiles to show seasonal changes in behavior, possible breeding patterns and many other miscellaneous information as it is required.

Below is an example of a graph from Liya's profiles. This reflects her general activity for one month (the month of January 2002).



CONCLUSION - BUT REALLY IT'S JUST THE BEGINNING...

To date we have incorporated a successful enrichment plan for all of our bears, including a progressive conditioning program that compliments the overall management of the animals and Polar Bear Shores. We believe it is successful because we have been able to curb and reduce stereotypic behavior, provide an ever-changing and stimulating environment which sees the polar bears engage in investigatory and foraging behaviors, as well as create a training program which enables us to maintain healthy (physically and psychologically) animals. All this, without any of the staff going prematurely grey! - with the exception of Des :)

We recognise that we are the “new kids on the block” when it comes to managing polar bears in captivity and we have learned incredible amounts from these bears and our experiences over the last 18 months. We hope to continue to learn, grow and be able to share our findings with other institutions, to build a better future for polar bears and for the conservation and preservation of these remarkable marine mammals.



Polar Bear Team (from left) Sharon Holden, Grant Amer, Kerrie Haynes-Lovell and Des Spittall with Ping Ping during his root canal surgery June 2001.

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Photos for this article taken by the author and Des Spittall, both members of the Polar Bear Shores Team; Marine Sciences Director Trevor Long; and personnel from the Sea World Australia Education Department.

Adventure Learning Program

Education has always played a key role in PBI's conservation efforts, with a goal of inspiring, informing, and motivating people. PBI groups its educational initiatives under an umbrella term, the "Adventure Learning Program." Following are descriptions of some of the major components.

Leadership Camp

PBI's Leadership Camp attracted worldwide attention when it was launched in the fall of 2004. Every fall, PBI invites top high school students from around world to travel to Churchill, Manitoba, during the polar bear migration to learn about polar bears and conservation issues. The students and their teachers spend an intense week on the tundra learning about all sides of the issues that affect polar bears and humans in the Churchill area. They report back to their classmates via daily Web journals. After the camp, each student creates a forward action plan to help educate their peers and create a new mind-set on conservation issues.



PBI's Leadership Camp Students in front of their roving classroom.

The leadership exhibited by participating students has been nothing short of remarkable. On their return, each of these young Ambassadors of the Arctic gives presentations to hundreds—and sometimes thousands—of other students. In addition their Web journals are read by tens of thousands of people. Millions more are reached through television and radio interviews and newspaper and magazine articles. The worldwide exposure and publicity received helps drive additional students to the PBI Web site to explore and understand the world of the polar bears. The PBI Newsletter also features the adventures and enthusiasm of these leaders, again creating a strong interest in conservation.



A Leadership Camp student emerging from a polar bear den.

Institutions participating in student selection for 2007 include the Alaska Zoo, Frontiers North Adventures, Louisville Zoo, Manitoba Conservation, Maryland Zoo, Oregon Zoo, PBI Australia, PBI Canada, San Diego Zoo, Scandinavian Wildlife Park, Sea World Australia, Smithsonian's National Zoo, and the Toledo Zoo.



A teacher and student working together to understand the process of creating a vision and motivating others to follow that vision.

This year, 14 high school students and six teachers from all over the world spent one intense October week studying polar bears and collecting field data with scientists. It was all part of PBI's third annual Polar Bear Leadership Camp. The students reported their discoveries back to tens of thousands of PBI Web site visitors through online journals.

The following are comments from students after they have experienced the PBI Leadership Camp.

Joseph Hopfner, Manitoba, Canada

You have no idea how much I have changed because of this experience. My mental perspective of the world has changed to a more intense level. I am now more educated in the domain of the environment, people, the way people think, the way people act, and the ways to appeal to them through conversations and presentations, all inspired by the amazing leaders we had taking care of us at camp.

Mikkeline Natorp, Denmark

On this trip I have met so many awesome persons, both adults and sub-adults. I have met people who were so passionate about the land, the animals and their culture that they have made a big impact on me. I have learned so much about the environment and the conflicts because of global warming. I have learned about people, the way they think and how to inspire and affect them through presentations and conversations. As Joseph said, "Every time you meet new people you change." I have met so many new people and changed alot.

Tamara Dorrington, Australia

I've come away from this experience with so much knowledge about myself and my ability to make a change and contribute to the world in a positive manner! This has been one of the most significant moments of my life and I know I will remember the things I did and the people I met for a very long time to come. This week has been very intense but my work has only just begun...

Emma Nice, Alaska, USA

This experience has made me think about how I will change when I get back home; how I will tell people how they can help change the effects of global warming and how I will act on this myself; how I will keep in touch with all the fabulous people who went on this trip; and how I will strive to see some of my fellow Arctic Ambassadors again in the future.

Betty - Aboriginal Elder - Guest Speaker

"To me the land is my mother.
She nourishes me, so it's up to me to respect her!"



Student holds a large male polar bear skull used to demonstrate how a polar bear can swallow a man's head in one bite.

(Photos provided by PBI)

Polar Bear Cam

Every fall, PBI and the Tundra Buggy® Adventure give viewers around the world the chance to watch the famous polar bear migration near Churchill via a live Web cam. Last year, the two formed an alliance with National Geographic to bring the popular cam to an even larger audience. The cam provides exciting footage of the bears as they play, sleep, and pad across the tundra while waiting for the bay to freeze. It also captures other Arctic wildlife including ptarmigan, Arctic fox, and snowy owls. Videographer Daniel Zatz, a four-time Emmy Award winner, operates the cam for six weeks in the fall, living and working on a roving Tundra Buggy. *National Geographic* photographer Daniel J. Cox, serves as the co-captain of the cam, capturing footage of the bears when Zatz is taking a break. Both Zatz and Cox serve on PBI's Advisory Council.

The Polar Bear Cam is a unique educational tool stimulates an interest in polar bear conservation and provides a better understanding of the Arctic and Subarctic environments. Every year, over a million visitors log on to watch the bears in action. After the migration is over, PBI adds highlights from the previous season to its Web site so that viewers can watch the bears on a year-round basis.

Distance Learning Classrooms

PBI has been successful in having field scientists teach live classes from the tundra via Web casts. The classes allow them to have one-on-one conversations with scientists in the field. The Web casts help students understand the problems facing polar bears; they also raise student awareness of the importance of the Arctic and the Subarctic and the role these regions play in the health of our planet. In addition, they provide students with a window into the world of a research scientist. We are now in the fourth year of this innovative program.

In previous years, more than 1,000 students participated in our live Web casts and over 30,000 viewers watched via our Web site. This year we will have participants from the Orlando Science Center, Roger Williams Park Zoo, The Maryland Zoo, Oregon Zoo, Alaska Zoo, Toledo Zoo, the Winnipeg School District, and Sea World Australia. Our teaching scientists this year will include Dr. Jane Waterman, Dr. Jim Roth, Dr. Steve Amstrup, and Dr. Don Moore.

Observation/Field Cameras

Last fall, PBI enlisted the help of an innovative camera company called SeeMore Wildlife to place two weather-resistant, remote-control cameras at a key migratory intersection along Western Hudson Bay during the annual gathering of polar bears. The noninvasive cameras were operated by scientists working on computers thousands of miles away, thus giving the researchers a better understanding of how polar bears behave when humans are not present. Dr. Jane Waterman and Dr. Jim Roth spearheaded the pilot phase of the project during a nine-week window in the fall. Six teams of high school students from around the world assisted them with observation and data-collection work, giving 300-plus students a chance to actively participate in polar bear research.

The pilot program proved so successful that PBI plans to continue it this fall. Not only do the cameras allow scientists to operate cameras from computers at remote work stations, but two sophisticated software systems are employed: one that gives estimates of a polar bear's height and weight and one that helps researchers identify individual bears via their whisker patterns. The closed-circuit high definition images are relayed back to Wapusk National Park Headquarters in Churchill, giving visitors the opportunity to experience this wildlife phenomenon while gaining a better understanding of the researchers' work. The same closed-circuit broadcast are also relayed to viewing audiences at educational institutions, and highlights are broadcast on the PBI Web site.

In-Field Lectures

During the fall bear-watching season in Churchill, PBI provides informal presentations by well-trained zoologists at no cost to tour operators. These PBI ambassadors go out into the field to give presentations on buggies. The lectures help visitors gain an understanding of the polar bear's physical

attributes, as well as its role in the wild and the conservation issues that the bears face. The field lectures include “touch and feel” tools provided by PBI such as samples of a polar bear’s fur, replicas of a polar bear skull and claws, ear tags, satellite collars, and images.

The in-field lectures have proven to be enormously popular with visitors, who are motivated and inspired to take conservation actions at home.

Churchill Lecture Series

Each year a number of talented individuals pass through Churchill during the polar bear migration. In 2004, PBI started to enlist the help of these people by asking them to take part in a free lecture series for residents and tourists. The lectures take place in the Civic Center Theatre to packed audiences and typically include renowned scientists, photographers, writers, adventurers and other knowledgeable polar bear enthusiasts. Audience members walkaway with a much better understanding of the incredible world in which the polar bear lives and what we must do to maintain a healthy Arctic environment.

Educational Materials

PBI publishes various educational materials to help the public learn about polar bears and the Arctic. These include:

- ◆ Mini posters with polar bear facts on the back
- ◆ A fun and informative quarterly newsletter
- ◆ World-class photography for educational purposes
- ◆ The world’s largest and most in-depth polar bear Web site

Polar Bear Fast Facts

- Female polar bears usually have two cubs. Though mating takes place in April or May, the fertile ova are not implanted until the following fall. This process is known as delayed implantation.
- The female polar bear gives birth to her cubs about two months after she enters the maternity den, usually by early January. Newborns are 12 to 14 inches long and weigh little more than a pound. They grow rapidly, however, by drinking their mother’s rich milk. The family remains in the den until March or early April.
- During the mother bear’s entire time in the maternity den—from four to eight months—she does not eat or drink. When she finally emerges with her cubs, she leads them to the sea ice so she can break her long fast by hunting seals.
- A mother bear’s success at hunting seals directly influences the well-being of her cubs. For at least 20 months, polar bear cubs drink their mother’s milk and depend on her for survival. During that time, they learn to hunt and meet the challenges of the Arctic. Females in the Low Arctic wean their cubs as they approach their second birthday, while those in the High Arctic, where conditions are more demanding, care for their cubs an additional year.

And they said it couldn't be done.....

Transportation of Two Polar Bears (*Ursus maritimus*) from Jardin Zoologique de Quebec to Sea World Australia

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On 17 May 2004, the Jardin Zoologique de Quebec in conjunction with the Quebec Society of Wildlife and Parks, were called to rescue two orphaned polar bear cubs from near Hudson Bay in Northern Canada. The details surrounding the death of the cubs mother is not fully known but it is believed that in a desperate hunger she had walked inland and had come close to a group of school children – sadly she was shot and the cubs were left alone. The cubs were put into transport crates and moved to their temporary home at Quebec Zoo.

The curator of Quebec Zoo put out a call to all interested parties from zoological institutions around the world for expressions of interest in housing the two cubs. Factors that were taken into account were facility design, enrichment programs and breeding potential. Applications were received from five countries around the world and the stringent selection process took approximately two months. Sea World was very pleased to learn that we were chosen as the most suitable facility.

Once we were informed of the decision we started the long and arduous task of applying for CITIES permits, making relevant transport arrangements and gaining approval from the Australian Quarantine Inspection Service (AQIS). There was nothing straightforward when making these preparations and this was unlike any transaction Sea World had ever undertaken. The two biggest hurdles was the fact that the cubs were wild-caught carnivores and only 10 months of age, and therefore had not been in captivity for 12 months or more as is necessary in AQIS criteria. AQIS were prepared to modify their import requirements to enable us to accept these cubs.

Sea World had to comply with stringent post-arrival quarantine requirements, extended from a typical 30-day quarantine period to six months, with all feces collected and treated as hazardous biological waste, staff required to be authorized by AQIS to enter the Polar Bear building, staff wearing special uniforms which could not leave the compound, footbaths at every door and the facility had to be sprayed with Vircon®, a disinfectant, between every bear move to ensure no cross-contamination between the cubs and resident bears.

The other major hurdle, and by far the one that proved the most difficult, was our inability to transport the cubs directly/freely from Canada to Australia.

Transporting any exotic animal, regardless of the size of the animal and the distance being traveled, is a difficult and involved process, let alone moving two polar bears across the other side of the world. What made this transport even harder is current legislation passed and enforced under the Marine Mammal Protection Act 1972 that forbids polar bear cubs less than 12 months of age that are wild-caught from entering the United States of America. This law exists to prevent the deliberate killing of female polar bears to gain access to the cubs. Due to the geographical proximity of Canada to the United States, this is a legitimate problem. In Australia the law exists for quarantine reasons.

While polar bears are still only considered a threatened species, their numbers are reducing quickly due to environmental pressures. A recent study has been conducted on the viability of polar bear numbers in their wild habitat and the shocking findings were at their current rate of decline, polar bears may only survive another 50 – 80 years (Derocher, Lunn, Stirling, 2004). Results of research like this, puts more emphasis and importance on facilities such as Sea World and the collaborative efforts of zoos worldwide to ensure the survival of this species.

Sea World is associated with the American Bear TAG and actively participates in annual meetings and studbook recommendations. The acquisition of these cubs will make a marked contribution to captive breeding populations and genetic diversity. Unfortunately, regardless of these links it was still made nearly impossible for us to transport these cubs from Canada to Australia.

Due to the current legislation our travel options were substantially reduced. The most direct route we could take was from Toronto to Alaska to refuel, from Alaska to Korea, and then on to Australia. Unfortunately, our permits were rejected to land in Alaska even though the stopover was for refueling only, and the cubs would not have left the cargo hold of the plane! Our final travel arrangements involved us trucking the cubs from Quebec to Montreal, flying under cargo from Montreal to Amsterdam, and a 24-hour stopover in Amsterdam staying in an animal hotel next to the airport. We joined a cargo flight from Amsterdam to Dubai, Dubai to Singapore, Singapore to Sydney, Sydney to Brisbane, and finally a one-hour truck ride to Sea World on the Gold Coast. The cubs spent a staggering 76 hours in their transport crates!! Had we been granted permission to refuel in Alaska, our travel time would of been reduced by nearly half. We were very fortunate that the transport crates were custom-made giving the cubs plenty of room. They had been conditioned to their crates prior to transport and they were traveling with people they were familiar with, but most importantly we were fortunate to have two cubs with very strong temperaments, and as a result they handled the journey better than we could of ever anticipated.

The legislation is warranted but we believe that it needs to be reviewed to take into account *bona fide* orphans. There are many zoos in the United States alone that house polar bears. Without the ability to be able to introduce such crucial genetics into the captive population, the genetic constitution of the population is substantially compromised, a frightening prognosis given the recent data on the status of their wild counterparts. It appears that efforts to safeguard wild populations may have an adverse affect on the management of orphaned individuals because the logistics of re-homing them seem unnecessarily difficult.

Unfortunately, it is not rare for Canadian Zoos to receive orphaned polar bear cubs. This is the second year in a row that Quebec Zoo has had to source homes for cubs and they tell us that it is becoming harder and harder to place the cubs; not because institutions don't want them but because they are so limited as to where they can send them. They have even said that they will have to rethink agreeing to take orphans in the future as they are running out of options and are not in a position to house them permanently. Thankfully they had not said this prior to Hudson and Nelson



One of the cubs enjoys a roll in the manmade snow of its new exhibit at SeaWorld Australia (Photo provided by Thylacinus)

being orphaned, because we would hate to think what the fate of these two young cubs would have been if Quebec Zoo had not been able to come to their rescue.

Our aim as conservationists is to manage captive populations so as to maintain the maximum level of genetic diversity. For a variety of reasons polar bear cubs will continue to be orphaned in the wild, hopefully at no fault of any zoological institution, therefore as an industry we need to encourage governing bodies to modify the existing legislation to enable us to introduce these crucial genetics into the captive population.

Polar bears are one of the few animal species that have a treaty signed by seven countries in order to protect them in their wild habitat. As an international group we need to encourage a review of the current legislation to allow more options for Canadian zoos to place orphaned cubs. Sea World respects the content of the Marine Mammal Protection Act, but would like to see governing authorities work more closely with the zoological community. With a little more collaboration between governing authorities and zoological institutions, we can ensure that polar bear numbers and genetics remain stable for future generations

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Polar Bear Status Report

Polar bears are a potentially threatened species living in the circumpolar north. They are animals that know no boundaries. They pad across the ice from Russia to Alaska, from Canada to Greenland and onto Norway's Svalbard archipelago. Due to the difficulty of counting bears in the Arctic (see related article on aerial surveys), no adequate census exists on which to base a worldwide population estimate, but biologists use a working figure of 20,000 to 25,000 bears.

In areas where long-term studies are available, populations are showing signs of stress. Canada's Western Hudson Bay population has dropped 22% since the early 1980s. The declines have been directly linked to an earlier ice break-up on Hudson Bay. A long-term study of the Southern Beaufort Sea population, which spans the northern coast of Alaska and western Canada, has revealed a decline in cub survival rates and in the weight and skull size of adult males. Such declines were observed in Western Hudson Bay bears prior to the population drop there. Another population listed as declining is Baffin Bay. According to the most recent report from the Polar Bear Specialist Group, the harvest levels from Nunavut when combined with those from Greenland (which were thought to be much lower than they actually are) has resulted in this shared population being in a non-sustainable harvest situation, meaning the population is at great risk of a serious decline. The harvest is thought to be several times above what is sustainable.

Some Native communities in Canada have been reporting increasing numbers of polar bears on land. Traditional hunters believe this indicates an increased population, although the increased presence on land may, in fact, be related to shrinking sea ice and changes in the bears' distribution patterns. Data is needed to understand the change.

Climate change is the main threat to polar bears today. A diminishing ice pack directly affects polar bears, as sea ice is the platform from which they hunt seals. Although the Arctic has experienced warm periods before, the present shrinking of the Arctic's sea ice is rapid and unprecedented.

In the 1960s and 1970s, hunting was the major threat to the bears. At the time, polar bears were under such severe survival pressure from hunters that a landmark international accord was reached, despite the tensions and suspicions of the Cold War. The International Agreement on the Conservation of Polar Bears was signed in Oslo, November 15, 1973 by the five nations with polar bear populations: Canada, Denmark (Greenland), Norway, the U.S., and the former U.S.S.R.

The polar bear nations agreed to prohibit random, unregulated sport hunting of polar bears and to outlaw hunting the bears from aircraft and icebreakers as had been common practice. The agreement also obliged each nation to protect polar bear denning areas and migration patterns and to conduct research relating to the conservation and management of polar bears. Finally, the nations agreed to share their polar bear research findings with each other. Member scientists of the Polar Bear Specialist Group now meet every three to four years under the auspices of the IUCN World Conservation Union to coordinate their research on polar bears throughout the Arctic.

The Oslo agreement was one of the first and most successful international conservation measures enacted in the 20th century. Its legacy continues today, with member scientists from each nation continuing to work together in face new threats to the bears including climate change, pollution, industrial activities, and poaching.

Polar Bears Proposed for ESA Listing as Threatened

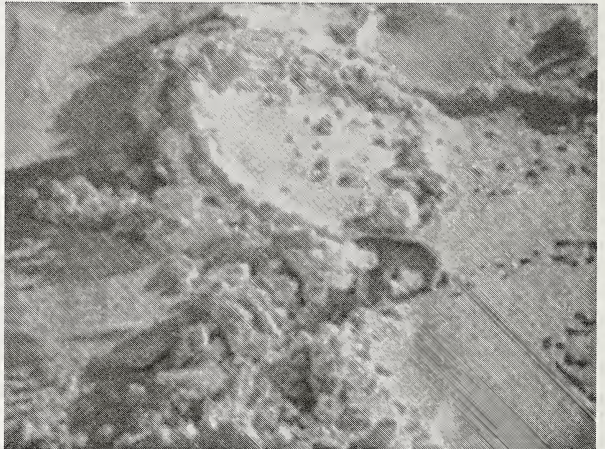
The U.S. Fish and Wildlife Service has proposed listing the polar bear as a threatened species under the Endangered Species Act. U.S. Secretary of the Interior Dick Kempthorne announced the decision on December 27, 2006.

“Polar bears are one of nature’s ultimate survivors, able to live and thrive in one of the world’s harshest environments,” he said. “But we are concerned the polar bears’ habitat may literally be melting.”

The proposal initiates a 12-month review period, during which time the Agency will gather more information before making a final decision.

Polar bear scientist Scott Schliebe, who serves on PBI’s Advisory Council, was the lead researcher for the listing. He noted that as the sea ice retreats, polar bears are finding it harder to reach seals, the mainstay of their diet.

“The Arctic is warming, and the trends are showing an acceleration in warming,” Schliebe said. “With that warming we’re seeing movements of warmer fresh water into the Arctic and continued reduction in the amount of sea ice. That ultimately will have an effect on the ability of polar bears to reproduce and survive.”



A polar bear approaches an open lead in Alaska
(Photo courtesy of Diana Weinhardt)

For more information on the listing, visit the PBI site at www.polarbearsinternational.org.

Frequently Asked Questions

U.S. Fish and Wildlife Service Proposal to List Polar Bears as Threatened Species

What is the current status of world polar bear populations? The total number of polar bears worldwide is estimated to be 20,000-25,000. Within Alaska, there are an estimated 4,700 animals shared with Canada and Russia in three populations - 1,500 in the Southern Beaufort Sea, 1,200 in the Northern Beaufort Sea, and 2,000 in the Chukchi Sea. The former two populations are shared with Canada, and the latter with Russia. There are no overall data on global polar bear population trends. However, long-term scientific studies in Canada's Western Hudson Bay have identified reduced adult weights and cub survivorship, resulting in a decline of that population to an estimated 935 animals — a 22% decline — correlated with loss of sea ice. More recent studies of the estimated 1,200 individuals in the Southern Beaufort Sea population in Alaska do not currently show a statistically significant decline, but this population is now experiencing the same pattern of reduced adult weights and cub survival as Western Hudson Bay. While such detailed studies are not available for other polar bear populations, the Service believes they may be facing the same situation, given their similar life history.

The projected threat to polar bears is the worldwide loss of their sea ice habitat. Recent data indicate a rapid and unprecedented retreat of Arctic sea ice (including earlier spring melt, later fall freeze-up and overall thinner ice) and there are projections of an ice-free Arctic Ocean within the foreseeable future. Since polar bears live on sea ice for a majority of the year and depend upon sea ice habitats for their key life functions, loss of sea ice would detrimentally affect all polar bears, world-wide.

What is the process for addressing a petition to add a species to the list of threatened and endangered species under the Endangered Species Act? The Endangered Species Act requires that the USFWS (Service) make a finding on whether a petition to list, delist, or reclassify a species presents substantial information indicating that the petitioned action may be warranted. This finding is based on information contained in the petition, supporting information submitted with the petition, and information otherwise available to the FWS at the time of the finding. To the maximum extent practicable, the Service makes this finding within 90 days of the receipt of the petition and publishes this 90-day finding promptly in the *Federal Register*. If the Service finds that substantial information is presented, it commences a review of the status of the species which is to be completed, if feasible, within 12 months of receipt of the petition. In the 12-month finding, one of three determinations can be made: (1) the petitioned action is not warranted; (2) the petitioned action is warranted, but precluded by other pending listing actions; or (3) the petitioned action is warranted, and the species is proposed for listing.

What is the Fish and Wildlife Service's decision on the petition to list the polar bear as a threatened species under the Endangered Species Act? Today, the Service is not making a final decision on this petition, however, based on currently available data, there is sufficient scientific evidence of a global threat to the polar bear to warrant proposing it for listing as a threatened species under the ESA. This is the next step in a lengthy process initiated in 2005, and which will still require much additional work to enhance existing scientific models and analyses before a final decision can be made on whether to list the species.

The Service will now actively seek additional scientific and commercial data, information, and will accept comments on the proposed rule for 90 days following the publication of the 12-month finding in the *Federal Register*. It will also hold one or more public hearings where the public can obtain information and offer comments. A copy of the proposed rule and other information about the proposal is available on the Internet at <http://alaska.fws.gov>. A final decision will be published one year from the date of this proposed rule.

What are the criteria for listing a species as threatened or endangered under the ESA? The Service's current proposal is to list the polar bear as "Threatened" throughout its range. As we evaluate public comments and any new information, we will consider all possible actions. By definition in the ESA, an "Endangered" species is likely to go extinct within all or a significant portion of its range, while a "Threatened" species is likely to become Endangered in the foreseeable future. Under threatened status the species is protected and managed for recovery, but FWS may also adopt special rules tailored to the conservation needs of the species.

The ESA requires that a species be listed if it is imperiled by one or more of the following five criteria:

- Present or threatened destruction, modification or curtailment of its habitat or range;
- Overutilization for commercial, recreational, scientific or educational purposes;
- Disease or predation;

- Inadequacy of existing regulatory mechanisms; or
- Other natural or manmade factors affecting its continued existence.

Thus identification of any one of these factors as a threat to a species can require the listing of the species under the ESA. In the case of the polar bear, the melting of sea ice is the potential threat to the species. The ESA does not discriminate between natural or manmade causes. In the case of polar bears, the decision to propose this listing as Threatened is based on the future effect of the continued expected modification or curtailment of its habitat or range, specifically from receding sea ice, and the absence of any known regulatory mechanisms at the national or international level effectively addressing this threat to polar bear habitat.

The ESA uses the term: “foreseeable future” - what is this? The ESA does not define “foreseeable future”, but it has often been interpreted to be a function of generations of the species in question and/or habitat regeneration cycles. In this status review, based on the opinion of polar bear experts, the Service has adopted three generations as the upper limit. Using this measure, since a polar bear generation is defined as 15 years, the “foreseeable future” addresses the next 45 years.

If the final decision is made to list the polar bear under the ESA, how would this listing help the species? The ESA requires that decisions be made solely on the basis of the five listing criteria outlined above, without regard to the level of knowledge or ability to address the threats to the species. A final decision to list the polar bear as threatened would not have any direct effect on the predicted reduction in sea ice habitat. However, listing would require the initiation of a recovery planning process, unless it is determined that this would not promote the conservation of the species. This planning process would include the cooperative efforts of International, Federal, State and local officials and agencies, Arctic Native groups, industry, and private entities to identify practical and feasible measures to provide for conservation of the species. Listing would also require Federal agencies to consult (under Section 7 of the ESA) with the Service for any actions which might affect polar bears within the United States.

Is sport hunting or subsistence harvesting of polar bears legal today? Hunting polar bears is prohibited by Norway and Russia, although some illegal harvest is occurring in Russia. Canada and Greenland allow subsistence take by Native communities as well as regulated sport hunting of certain populations. In the United States, the Marine Mammal Protection Act prohibits sport hunting, but subsistence harvest of polar bears by Alaskan Natives is allowed.

If polar bears may be threatened, how can we allow any harvest or utilization at all? Subsistence harvest of polar bears is of great social, cultural and economic importance to Native peoples throughout much of the Arctic, and the proposed rule finds that subsistence harvest is not a threat to the species. Therefore, maintaining a harvest within sustainable limits, in relation to population sizes and trends, remains a priority for the Service. If the species is listed as threatened, the subsistence harvest by Alaskan natives currently allowed under the Marine Mammal Protection Act would continue to be allowed under the Endangered Species Act. This situation would change only if there was a change in subsistence harvest which resulted in a material, negative impact on polar bear populations.

Some Native communities in arctic Canada also obtain significant financial benefits from allocating a portion of their overall subsistence quota to trophy hunters from the United States and other nations, and from providing guiding services to such hunters. Under standards set by the Marine Mammal Protection Act, the Service currently allows the import of sport-hunted trophies only from those Canadian populations which have a sustainable harvest. If the species is listed as threatened, the Service would work with the Marine Mammal Commission, Congress, and all interested parties to consider a special rule allowing continued import of trophies from healthy populations.

Is it true that Native groups in some of these areas claim that traditional knowledge indicates that local polar bear populations are actually increasing? The Service respects and makes use of traditional knowledge in all of its decision-making processes, and will evaluate information from Arctic Native communities in Baffin Bay, Davis Strait, Western Hudson Bay, and other areas of Canada, which have recently reported increasing numbers of bears present on land. These traditional hunters believe this indicates an increased population, though others note that this could just be the result of a change in polar bear distribution. In the declining polar bear population of Canada's Western Hudson Bay, extensive scientific studies have indicated that the increased observation of bears on land is a result of changing distribution patterns and a result of changes in the accessibility of sea ice habitat.

Are there reliable figures for changes in the Arctic sea ice cap over the last several decades? Observations have shown a decline in late summer Arctic sea ice to the extent of 7.7% per decade and in the perennial sea ice area of 9.8% per decade since 1978. Observations have likewise shown a thinning of the Arctic sea ice of 32% from the 1960s and 1970s to the 1990s in some local areas.

Why is the sea ice melting? The predominant reasons for amplified decreases in the extent of sea ice are: (a) the sea ice albedo effect (i.e., less sea ice cover, which has a high reflectivity, causes more absorption of solar radiation in the ocean and hence more heat storage in the ocean, and a warmer ocean further delays formation of new sea ice cover in the fall); (b) the thinning of the sea ice (including the reduction in perennial ice), which leads to more rapid melting of sea ice; (c) an increase in melt season length, which enhances the ice albedo feedback, and decrease in ice season length, which limits the winter ice extent and the average thickness of ice during the season; and (d) the movement of ice out of the Arctic Ocean. The National Snow and Ice Data Center in Boulder, CO, using satellite images, estimates that the Arctic ice cap has shrunk by 20% since 1979.

Specifically, how does loss of sea ice threaten polar bears? Although some females will use snow dens on land for birthing cubs, polar bears are almost completely dependent upon Arctic sea-ice for survival. They use sea ice as a platform from which to hunt and feed upon seals, to seek mates and breed, to move to maternity denning areas on land, and to travel long distances. Thus any significant changes in the abundance, distribution, or existence of sea ice would have profound effects on all stages of the animal's life cycle.

Are polar bears currently recognized as being an at-risk species by any nations or organizations? Polar bears are listed as species of concern in both Canada and in Russia. In addition, in June 2005, the IUCN World Conservation Union's Polar Bear Specialist Group, which includes the world's leading polar bear scientists, reclassified polar bears under the IUCN's "Red List of Threatened Species" to be a species vulnerable to global extinction due to sea ice change, with prediction of more than a 30% population decline in the next 45 years.

What is currently being done to protect polar bears in Alaska? There are three polar bear populations in Alaska: the Southern Beaufort Sea population, estimated 1,500 animals, shared with Canada; the Northern Beaufort Sea population, estimated at 1,200 animals, also shared with Canada; and the Chukchi Sea population, estimated 2,000 animals, shared with Russia.

Management of these polar bears is already the responsibility of the Service under the Marine Mammal Protection Act, and the U.S. Geological Survey (Survey) is also actively involved in research. The Service and the Survey are pursuing an active program, in cooperation with a broad array of organizations, which includes studying population status and trends, learning more about polar bear relationship to sea ice habitat, monitoring subsistence harvest, and minimizing bear-human conflicts, among many other topics, all designed to help conserve polar bears in the face of a changing environment.

What additional research efforts would most benefit polar bears? Current projections of the future status of polar bears are based on models of the effects of a changing environment on polar bear populations. Much new information and effort is needed to develop and enhance these models and improve confidence levels in our understanding of the future of polar bears. This will play a key role in the decision about what is needed to ensure the conservation of polar bears.

How would oil and gas development affect polar bears? There is an extensive database of knowledge about how to incorporate measures to ensure the conservation of polar bears from oil and gas development in the North Slope. Based on mitigation measures in place now and likely to be used in the future, historical information, the lack of direct quantifiable impacts to polar bear habitat from these activities, and the localized nature of these potential development activities or spills, the proposed listing of the polar bear finds that these activities will not threaten the species throughout all or a significant portion of its range.

The Service and the industry have worked cooperatively for many years to develop and implement regulations specifying appropriate safety measures for both workers and polar bears. Mitigation measures and polar bear encounters are tracked and evaluated through the Service's Marine Mammal Protection Act Incidental Take Program.

What is the perspective of the Administration on climate change, in light of this proposal to list the polar bear due to threats of sea ice melting? The Administration treats climate change very seriously and recognizes the role of greenhouse gases in climate change. The Administration is taking aggressive steps to implement a sensible course of action, promoting a widespread use of the best of today's technologies and accelerating the time when new technologies are available to make even greater progress.

The Administration says it is committed to a portfolio of actions. More than \$29 billion is dedicated to

climate science and research, and more than 60 mandatory, incentive-based, and voluntary programs and smart choices by consumers to meet the President's goal of reducing greenhouse gas intensity 18% by 2012.

These actions include:

- voluntary partnerships with 15 trade associations representing 14 industry sectors to meet specific goals to address greenhouse gases;
- an international methane-to-markets partnership with specific reduction targets for methane;
- new fuel standards for light trucks;
- new mandatory appliance efficiency standards;
- the awarding by the Treasury of \$1.3 billion in tax credits to leverage over \$10 billion in clean coal, low carbon energy;
- an Asia-Pacific partnership with six nations that include half the world's populations and half the greenhouse gas emissions to advance clean energy, reduce greenhouse gas emissions, and enhance economic development.

Much of the science cited in the document proposing listing of the polar bear regarding sea ice conditions was generated as part of this Administration's level of investment in climate research. The President has acknowledged that the globe is warming and that human factors are a contributing factor. *Source: U.S. Fish and Wildlife Service*

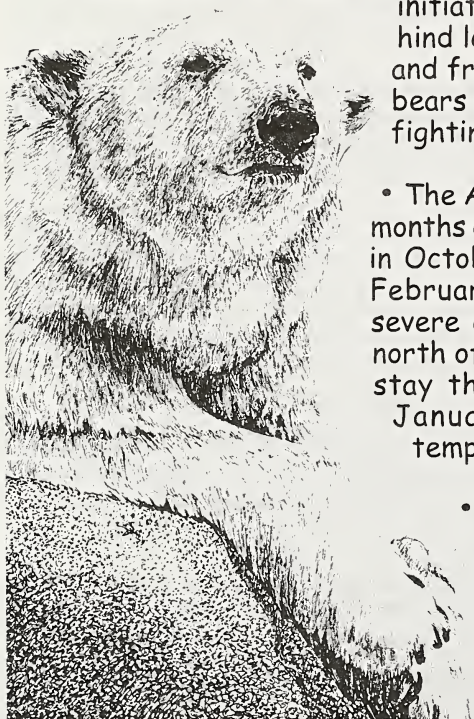
Polar Bear Fast Facts

- Polar bears communicate with each other through a combination of body language and vocalizations. A deep growl serves as a warning to other bears. Growls are frequently employed to defend a food source. Among polar bears, hissing and snorting signify aggression, as does a lowered head. An attacking polar bear will charge forward with head down and ears laid back. Submissive polar bears always move downwind of dominant bears.

- When a polar bear wants to play, he communicates this to another bear by wagging his head from side to side. An adult bear may also initiate play sessions by standing on his hind legs, with chin lowered to his chest and front paws hanging by his side. In adult bears such play sessions involve ritualized fighting or mock battles.

- The Arctic stays black and fiercely cold for months on end. In the High Arctic, the sun sets in October and does not rise again until late February. Polar bears are well-adapted to severe cold. Winter temperatures in the far north often plunge to -40° F or -50° F and can stay that way for days or even weeks. In January and February, the average temperature in the high Arctic is -29° F.

- Polar bears are champion swimmers. They have been known to swim more than 60 miles without a rest. They have been clocked swimming as fast as six miles per hour. Their swimming limit is not known. Polar bears have excellent underwater vision. They can spot food up to 15 feet away.



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